C.1 INTRODUCTION AND BACKGROUND

The National Oceanic and Atmospheric Administration (NOAA) is an agency that enriches life through science. NOAA's reach goes from the surface of the sun to the depths of the ocean floor as NOAA works to keep citizens informed of the changing environment around them. NOAA provides environmental intelligence for the nation. From daily weather forecasts, severe storm warnings, and climate monitoring to fisheries management, coastal restoration, and maintaining marine commerce, NOAA's products and services support economic vitality and more than one-third of America's gross domestic product. The people of NOAA use research and tools to provide citizens, planners, emergency managers, and other decision makers with reliable and timely environmental intelligence.

C.2 OBJECTIVES

The overall objectives of the ProTech program are to:

1. Obtain high-quality professional, technical, and scientific services
2. Develop an industrial base of partners
3. Develop and maintain performance-based contracts
4. Contribute to the NOAA mission

Services not covered by the Satellite Domain scope of work include the following:

1. Architect and Engineering (A&E) Services subject to the Brooks Act and FAR Subpart 36.6 acquisition procedures;
2. Inherently Governmental functions – see the prohibition at FAR 7.503(a);
3. Personal services as defined in FAR 37.104(a);
4. Legal services;
5. Requirements where the primary objective or the predominance of the work is to obtain information technology (IT) services; and
6. Requirements for any IT products and services, except where (1) the IT cannot feasibly be separated from the non-IT requirements or (2) when the IT is incidental to contract performance.
    a. IT is defined by Office of Management and Budget (OMB) Memorandum 15-14, *Management and Oversight of Federal Information Technology*, as: Any services or equipment, or interconnected system(s) or subsystem(s) of equipment, that are used in the automatic acquisition, storage, analysis, evaluation, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the agency; where such services or equipment are 'used by an agency' if used by the agency directly or if used by a contractor under a contract with the agency that requires either use of the services or equipment, or requires use of the services or equipment to a significant extent in the performance of a service or the furnishing of a product. If delivering IT products or services, the contractor shall comply with government IT standards, such as those for

IT security, and with requirements for sharing and efficiency at the federal, agency, bureau, and line office levels.

b. IT is incidental to a contract when the IT services or products are neither contract deliverables nor create, modify, operate or maintain IT used by the government or on its behalf.

C.3 SATELLITE DOMAIN SCOPE

The mission and objectives of the primary users of the Satellite Domain are related to satellite and observation activities and the collection, preservation, and dissemination of information and services derived therefrom. The National Environmental Satellite, Data, and Information Service (NESDIS) is dedicated to providing timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life. To fulfill its responsibilities, NESDIS acquires and manages the Nation's operational environmental satellites. NESDIS provides data and information services including space weather and Earth system monitoring. NESDIS performs data and information product stewardship and preservation. NESDIS develops and produces information products, applications, tools, and models derived from observed data. NESDIS performs official assessments of the space and Earth's environment and conducts related applied research. NOAA's environmental satellite data are essential for forecasting the weather/oceans/cryosphere, analyzing environmental/climate phenomena, and monitoring hazards worldwide. This 24/7 global coverage provides a constant stream of information used for making decisions with respect to events that impact our climate, weather, oceans, and daily lives. Other NOAA offices may also use the contracts awarded within this Domain for their in-scope requirements.

All services provided in support of the **Elements** in Sections C.3.1 and C.3.2 shall align with one or more of the following **"Mission Focus Areas"**:

1. Providing timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life;
2. Designing, analyzing, developing, acquiring, or managing operational environmental satellites, their payloads and supporting ground systems;
3. Providing data and information services, including space weather and Earth system monitoring;
4. Performing data and information product stewardship and preservation;
5. Developing and producing information products, applications, tools, and models derived from observed data;
6. Performing official assessments of the space or Earth's environment, and conduct related applied research; and
7. Forecasting and modeling the weather/oceans/cryosphere, analyzing environmental/climate phenomena, and monitoring hazards worldwide.

The services provided under ProTech Satellite will support sites worldwide, which include, but may not be limited to, Fairbanks, Alaska; Silver Spring (NOAA Headquarters), College Park, Greenbelt, and Lanham, Maryland; Wallops and Ashburn, Virginia; Boulder, Colorado;

Asheville, North Carolina; Stennis, Mississippi; Townsville, Australia; and international partnership facilities.

The Contractor shall furnish the necessary personnel, materials, equipment, facilities, travel, and other services required to satisfy task order requirements. The suite of resulting contracts for this Domain is intended to satisfy the need for professional, technical, and scientific services to support the full range of related requirements for observing system activities, including satellite missions, which NOAA manages or in which NOAA participates, and managing the space and Earth environmental data that results from those missions. Increasingly, NESDIS is looking for synergies in collaborating with domestic and international, public and commercial, partners through joint missions, opportunity payloads and even data procurement. NESDIS work is conducted at NOAA headquarters, as well as in regional offices, science centers, data centers, associated field offices, laboratories, contractor facilities, and other field locations.

For additional information about NESDIS, see http://www.nesdis.noaa.gov/about_satellites.html or the NOAA Research and Development Vision Areas 2020-2026, see https://sciencecouncil.noaa.gov/LinkClick.aspx?fileticket=Mo2PSTqzuJk%3D&portalid=0.

C.3.1 Professional Services

In order to fulfill its critical mission, NOAA relies on industry for a wide assortment of professional, technical, and scientific services. The large number and variety of services listed in this PWS is so great that there is no reasonable expectation that they can all be acquired from a single contractor. Moreover, relying on a single contractor would incur mission risk to NOAA due to lack of redundancy and an insufficient industrial base to ensure mission success into the future. Accordingly, through the ProTech Program, NOAA intends to achieve a set of service providers who ***collectively*** can provide the necessary services, while also ensuring NOAA high-quality technical and scientific solutions to its task orders through the competition of industry-leading service providers.

Section C.3.1 details the Professional Services required for this contract. The professional services are broadly classified as Program and Project Management (Professional Service Area 1), Business Services (Professional Service Area 2), and Communication Services (Professional Service Area 3). Although Professional Services are differentiated from the Technical and Scientific Services of Section C.3.2, NOAA expects that the conduct of the Professional Services will be fully informed by appropriate science and engineering subject matter expertise.

Fully Informed Professional Services are Professional services whose quality of products and services have a strong dependency upon the Contractor's relevant scientific and technical competency. Some professional services of this type, in fact, cannot be feasibly separated from the scientific and technical requirements. An example would be the project management service of producing a proposed project plan, work breakdown structure and cost estimate for a NESDIS in-house scientific or technical research or development project. In this case, the quality of the deliverables would be strongly affected by the Contractor's scientific or engineering knowledge of the particular research or development domain.

Table 1 (below) lists the Professional Services required for this contract. Each table row represents a work statement "**Element**." Elements are organized within "**Professional Service Areas."**

Each element is defined by the following requirements:

1. The specifications listed in each element;
2. The specifications of each element's Professional Service Area; and
3. The specifications of the definitions found at General Definitions, Section C.4.

NOAA requires contractors to perform all of the listed Professional Services; however, no individual contractor is required to provide all of the listed services. Instead, NOAA will award contracts to a set of service providers who collectively can perform all of the required Professional Services, and can provide NOAA with competition for coverage of services at the task order level.

The Professional Service elements are as follows:

Table 1 - Professional Service Elements

Professional Service Area 1: Program & Project Management Services	
Professional Service Area 1.A: Budget and Financial Management *Services under this Service Area support NESDIS budget and financial management activities.*	
C.3.1.1	Budgets and Budget Estimation
C.3.1.2	Financial and Cost Management Services
Professional Service Area 1.B: Performance Management *Services under this Service Area support resource-efficient, budget- and schedule-accountable, program or project execution in order to deliver products or provide services responsive to stakeholder objectives or requirements.*	
C.3.1.3	Program and Project Management
C.3.1.4	Earned Value Management
C.3.1.5	Change Management
C.3.1.6	Document & Record Management
C.3.1.7	Performance Baselines
C.3.1.8	PMBOK®-Informed Best Practices
C.3.1.9	Program & Project Plans

C.3.1.10	Quality Management
C.3.1.11	Risk Management
Professional Service Area 1.C: Resource Management *Services under this Service Area support the responsible custodianship of NESDIS assets (excluding real estate) through attentive inventory data entry and periodic inventory audits, ensuring programs are compliant with regulations. Services will assist with the planning, coordination, execution and confirmation of program asset relocation.*	
C.3.1.12	Property, Inventory Management & Tracking
C.3.1.13	Logistics
Professional Service Area 1.D: Schedule Management *Services under this Service Area support various tools produced, maintained, or monitored to ensure timely project execution or requirement-compliant deliveries.*	
C.3.1.14	Schedules, Timelines, Milestones, Roadmaps
C.3.1.15	Work Breakdown Structures
Professional Service Area 2: Business Services *Services under this Service Area ensure that NESDIS science, engineering, and technical program or project planning is based on equally sound science and business cases, and that execution is based on sound business principles. For example, services to support cost-risk studies of autonomous vehicle parts sparing should be equally informed by technical parameters such as Mean Time Between Failure or replacement compatibility, while being equally cognizant of business aspects, such as supply chain uncertainty and risk.*	
C.3.1.16	Acquisition & Grants Assistance
C.3.1.17	Action & Tasker Management
C.3.1.18	Conduct Informal Opinion Surveys & Collect Feedback
C.3.1.19	Configuration Management
C.3.1.20	Coordination, Facilitation, Planning
C.3.1.21	Cost-Risk Studies, Trade Studies
C.3.1.22	Economic & Social Science Analysis
C.3.1.23	Evaluate Deliverables

C.3.1.24	Observing System Investments[1]
C.3.1.25	Policy & Regulation Compliance (e.g. Legislative, Security)
C.3.1.26	Procedure/Process Analysis, Engineering & Improvement
C.3.1.27	Program/Project Function & System Criticality[2]
C.3.1.28	Strategic Planning
Professional Service Area 3: Communications Services *Services under this Service Area support dissemination of information. The information will range in technical complexity from being suitable for elementary school students to state-of-the-science defining sophistication. The dissemination platforms will range from classroom lectures to symposium presentations to social media posts.*	
C.3.1.29	Business Writing & Documentation
C.3.1.30	Graphics, Social Media, Web, Video, Visualization
C.3.1.31	Public Education, Engagement, Outreach & Training
C.3.1.32	Technical Education, Engagement, Outreach & Training
C.3.1.33	Technical Writing incl. Briefs, Presentations, Publications

C.3.2 Technical and Scientific Services

In order to fulfill its critical mission, NOAA relies on industry for a wide breadth of professional, technical, and scientific services. The breadth of needed services is so great that there is no reasonable expectation that they can all be acquired from a single contractor. Moreover, relying on a single contractor would incur mission risk to NOAA due to lack of redundancy and an insufficient industrial base to ensure mission success into the future. Accordingly, through the ProTech Program, NOAA intends to achieve a set of service providers who ***collectively*** can provide the necessary services, while also ensuring NOAA high-quality technical and scientific solutions to its task orders through the competition of industry-leading service providers.

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[1] Observing System Investments includes strategic or tactical research and recommendations of science or technology whose procurement would render a benefit to NESDIS in meeting its missions and objectives. Benefits may be realized through cost, schedule or performance efficiencies gained. The subject of the research could be physical equipment, such as state of the art antenna control systems, or intellectual, as in a strategic, synergistic partnership that delivers a new, high resolution data source. The procurement could be made at any phase of the mission lifecycle.

[2] Program/Project Function & System Criticality includes analysis of NESDIS programs or projects to assess the utility, value, or effectiveness of their function and systems towards fulfilling NESDIS missions and objectives. Such analyses may examine technical facets of programs or projects, or focus on business (professional services) aspects of the program or project, with regard to the holistic NESDIS enterprise.

Section C.3.2 details the classes of Technical and Scientific Services required for this contract. The technical and scientific services are broadly classified as Architecture Services (Technical and Scientific Service Area 1) and Scientific and Engineering Services (Technical and Scientific Service Area 2).

Table 2 (below) lists the Technical and Scientific Services required for this contract. Each table cell represents a work statement "**Element**." Elements are organized within "**Technical and Scientific Service Areas."** Several Technical and Scientific Service Area descriptions include hyperlinks to NESDIS offices or programs, to provide context or representative illustrations. Such illustrations do NOT require Offeror expertise or experience in the Service Area to be restricted exclusively to NESDIS.

Each element is defined by the following requirements:

1. The specifications listed in each element;
2. The specifications of each element's Technical and Scientific Service Area; and
3. The specifications of the definitions found at General Definitions, Section C.4.

NOAA requires contractors to perform all of the listed Technical and Scientific Services; however, no individual contractor is required to provide all of the listed services. Instead, NOAA will award contracts to a set of service providers who collectively can perform all of the required Technical and Scientific Services, and can provide NOAA with competition for coverage of services at the task order level.

Most elements in this section contain mission phases, or "**Lifecycles."** Lifecycles are defined by the following requirements:

> **Analysis:** Generally requires leveraging subject matter expertise for the purpose of rendering a professional assessment, evaluation, opinion, suggestion or recommendation delivered in some form of document such as a brief, white paper or publication. The subject of analyses may range from evaluating program process and procedure effectiveness to identifying gaps in data dissemination or satellite imagery-derived oceanic products or command and control operations. Analysis may require independent research or data gathering and interpretation.
>
> **Development:** Development is defined broadly to include design and fabrication, as well as common supporting ancillary services such as coordination, demonstration, implementation, testing, integration, transition to operations, and delivery of accompanying documentation. Products or services may be developed in different degrees of maturity ranging from prototypes and concept proofs to final mission-operational versions.
>
> **Execution:** Execution generally requires product or service delivery, but may also encompass certain post-delivery services such as tasks to maintain and sustain service delivery. Execution can involve oversight of service delivery, as in independent validation and verification, to ensure requirement compliance. Execution can often entail

troubleshooting anomalous circumstances, or tasks which result in enhanced or expedited service delivery.

The Technical and Scientific Service Elements are as follows:

Table 2 - Technical and Scientific Service Elements	
Technical and Scientific Service Area 1: Systems Architecture *Services under this Service Area support systems architecture, defined as the formal representation and description of a system designed, built, and operated to satisfy the product or service requirement of an enterprise. A systems architecture specifies its components, their interfaces (including its interface to the extra-system environment or human operator), interconnectivity, and functional performance. A systems architecture may be high-level and notional, or low-level and detailed, possibly including facilities, hardware, software, and network component inventories. The systems architecture guides the system development, implementation and future evolution of a system.*	
C.3.2.1	Advanced/Future/Innovative
C.3.2.2	Archival and Working Data Storage
C.3.2.3	Enterprise or System Ground Segment Data
C.3.2.4	Enterprise or System Ground Segment Products
C.3.2.5	Enterprise or System Ground Segment Satellite Operations (SatOps)
C.3.2.6	Flight Segment[3]
C.3.2.7	Global Earth Observation System of Systems (GEOSS) Alignment, Coordination
C.3.2.8	In Situ Observing Systems
C.3.2.9	Observing Systems[4]
C.3.2.10	Satellite Communications & Data Backhaul
C.3.2.11	Satellite Observing Systems
Technical and Scientific Service Area 2: Science and Engineering	

[3] Flight Segment requires contractors to provide services for the design or analyses specifically for the flight segment of an observing system architecture. This could range from conceptual or exploratory designs of new missions to modifications or enhancements to an existing flight segment architecture.
[4] Observing Systems requires contractors to provide services for the design or analyses of interconnected (physically or logically) environmental sensing instrumentation. Observing systems may include any, all or various combinations of terrestrial, river-based, coastal, oceanic, airborne or space environmental sensing elements, including the mechanisms for their interconnectivity.

Technical and Scientific Service Area 2.A: Algorithms *Services under this Service Area support algorithms, defined as systematic procedures for processing input data into a derived data product or for automated reasoning. For example, scheduling algorithms prescribe which one of several candidate satellites passing a ground station antenna will be supported, based on mission priority, satellite priority, and onboard data priority, volume and timeliness. In this context, an algorithm is more notional in defining the scientific, technical or engineering specifications of the processing, in distinction to the implementation of the algorithm in a programming language to execute on a Central Processing Unit (CPU).*	
C.3.2.12	Algorithms - Advanced/Future/Innovations
C.3.2.13	Algorithms - Calibration, Validation, Verification
C.3.2.14	Algorithms - Development Environments, Testbeds
C.3.2.15	Algorithms - Maintenance & Sustainment
C.3.2.16	Algorithms - Research to Operations, Operations to Research (R2O, O2R)
C.3.2.17	Algorithms - Stewardship & Quality Assurance
Technical and Scientific Service Area 2.B: Antennas or Antenna Systems *Services under this Service Area support antennas or antenna systems, defined as hardware and software that implements the interface between electromagnetic radiation and the transmitter or receiver element of a system. NESDIS antenna assets include transmitting and receiving antennas on its spacecraft, aircraft, in situ sensors, and on-ground antennas at its command and data acquisition stations, international stations, backup sites, and field offices.*	
C.3.2.18	Antennas or Antenna Systems - Advanced/Future/Innovations
C.3.2.19	Antennas or Antenna Systems - Anomaly Troubleshooting or Resolution
C.3.2.20	Antennas or Antenna Systems - Calibration, Validation or Verification
C.3.2.21	Antennas or Antenna Systems - Compatibility, Interfaces, Integration
C.3.2.22	Antennas or Antenna Systems - Engineering
C.3.2.23	Antennas or Antenna Systems - Maintenance & Sustainment
C.3.2.24	Antennas or Antenna Systems - Monitoring or Performance
C.3.2.25	Antennas or Antenna Systems - Planning
C.3.2.26	Antennas or Antenna Systems - Mission Operations
C.3.2.27	Antennas or Antenna Systems - Transition to Operations

Technical and Scientific Service Area 2.C: Applications *Services under this Service Area support applications, defined as software resources and their associated data that perform a function for an end user. For example, an orbit analysis application can predict the times of satellite entrance and exit of the Earth's penumbra. One or more discrete computer programs may comprise an application. Applications may support NESDIS directly, such as product generation applications, or indirectly, such as a tool that monthly audits the timeliness of product generation.*	
C.3.2.28	Applications - Advanced/Future/Innovations
C.3.2.29	Applications - Calibration, Validation, Verification
C.3.2.30	Applications - Data Analysis & Display
C.3.2.31	Applications - Development Environments, Testbeds
C.3.2.32	Applications - Documentation
C.3.2.33	Applications - Environmental Monitoring
C.3.2.34	Applications - Maintenance & Sustainment
C.3.2.35	Applications - Research to Operations, Operations to Research (R2O, O2R)
C.3.2.36	Applications - Stewardship & Quality Assurance
Technical and Scientific Service Area 2.D: Data (Includes Data Systems, Databases, Datasets) *Services under this Service Area support data, defined as information in any format that can be subjected to inspection, analysis, transformation, storage and retrieval, by humans, computers or a combination of the two.*	
C.3.2.37	Data - Advanced/Future/Innovations
C.3.2.38	Data - Archive, Storage
C.3.2.39	Data - Calibration, Validation, Verification
C.3.2.40	Data - Collection, Ingest
C.3.2.41	Data - Collection Campaigns, Expeditions, Surveys, Sorties
C.3.2.42	Data - Compatibility, Interfaces, Integration
C.3.2.43	Data - Development Environments, Testbeds
C.3.2.44	Data - Dissemination, Distribution
C.3.2.45	Data – Formats
C.3.2.46	Data – Fusion

C.3.2.47	Data - Historical Trending
C.3.2.48	Data - Interpretation
C.3.2.49	Data - Processing
C.3.2.50	Data - Procurement of Commercial or Private
C.3.2.51	Data - R2O, O2R
C.3.2.52	Data - Stewardship & Quality Assurance[5]
Technical and Scientific Service Area 2.E: Flight Segment *Services under this Service Area support program flight segments. A flight segment is defined as a collection of airborne and spaceborne hardware, software and communications resources to support all phases of an observing system lifecycle.*	
C.3.2.53	Flight Segment - Advanced/Future/Innovations
C.3.2.54	Flight Segment - Anomaly Troubleshooting, Resolution
C.3.2.55	Flight Segment - Calibration, Validation, Verification
C.3.2.56	Flight Segment - Engineering
C.3.2.57	Flight Segment - Compatibility, Interfaces, Integration
C.3.2.58	Flight Segment - Monitoring, Performance
C.3.2.59	Flight Segment - Planning
C.3.2.60	Flight Segment - Pre-Launch, Launch, Early Orbit Raising
C.3.2.61	Flight Segment - Mission Operations
C.3.2.62	Flight Segment - Flight Software
C.3.2.63	Flight Segment - Transition to Operations
Technical and Scientific Service Area 2.F: Ground Segment - Data Systems *Services under this Service Area support the data systems elements of a program's ground system. The ground segment is defined as the collection of on-ground hardware, software, network and communication resources that support all phases of an observing system lifecycle. For representative background information about NESDIS data systems refer to https://www.ncei.noaa.gov/about*	
C.3.2.64	Ground Segment - Data Systems - Advanced/Future/Innovations

[5] Quality assurance requires contractors to provide analysis, identification, correction, and documentation of erroneous data and derived information throughout the life cycle of the data.

C.3.2.65	Ground Segment - Data Systems - Anomaly Troubleshooting, Resolution
C.3.2.66	Ground Segment - Data Systems - Calibration, Validation, Verification
C.3.2.67	Ground Segment - Data Systems - Engineering
C.3.2.68	Ground Segment - Data Systems - Compatibility, Interfaces, Integration
C.3.2.69	Ground Segment - Data Systems - Monitoring, Performance
C.3.2.70	Ground Segment - Data Systems - Mission Operations
C.3.2.71	Ground Segment - Data Systems - Transition to Operations
Technical and Scientific Service Area 2.G: Ground Segment - Products *Services under this Service Area support the product generation elements of a program's ground system. The ground segment is defined as the collection of on-ground hardware, software, network and communication resources that support all phases of an observing system lifecycle.* *Background information about NESDIS product generation is found at https://www.star.nesdis.noaa.gov/star/aboutSTAR.php and for some NESDIS programs with product generation elements refer to https://www.ospo.noaa.gov/Services/index.html*	
C.3.2.72	Ground Segment - Products - Advanced/Future/Innovations
C.3.2.73	Ground Segment - Products - Anomaly Troubleshooting, Resolution
C.3.2.74	Ground Segment - Products - Calibration, Validation, Verification
C.3.2.75	Ground Segment - Products - Engineering
C.3.2.76	Ground Segment - Products - Compatibility, Interfaces, Integration
C.3.2.77	Ground Segment - Products - Monitoring, Performance
C.3.2.78	Ground Segment - Products - Mission Operations
C.3.2.79	Ground Segment - Products - Transition to Operations
Technical and Scientific Service Area 2.H: Ground Segment - Satellite Operations (SatOps) *Services under this Service Area support the satellite operations elements of a program's ground system. The ground segment is defined as the collection of on-ground hardware, software, network and communication resources that support all phases of an observing system lifecycle. Satellite operations includes services for maintaining satellite health and safety such as: telemetry downlink and monitoring, command uplink, orbit and attitude tracking and maintenance, payload monitoring and broadcast performance monitoring.* *Background information about NESDIS programs with product generation elements refer to*	

https://www.ospo.noaa.gov/Operations/satellite_operations.html	
C.3.2.80	Ground Segment - SatOps - Advanced/Future/Innovations
C.3.2.81	Ground Segment - SatOps - Anomaly Troubleshooting, Resolution
C.3.2.82	Ground Segment - SatOps - Calibration, Validation, Verification
C.3.2.83	Ground Segment - SatOps - Telemetry, Command, Control, Communications
C.3.2.84	Ground Segment - SatOps - Engineering
C.3.2.85	Ground Segment - SatOps - Compatibility, Interfaces, Integration
C.3.2.86	Ground Segment - SatOps - Monitoring, Performance
C.3.2.87	Ground Segment - SatOps - Mission Operations
C.3.2.88	Ground Segment - SatOps - Pre-Launch, Launch, Early Orbit Raising
C.3.2.89	Ground Segment - SatOps - Transition to Operations
Technical and Scientific Service Area 2.I: Instruments, Sensors (Includes airborne, spaceborne or *in situ*) *Services under this Service Area support instruments and sensors. Instruments and sensors are defined as equipment that collects data read or "sensed" from an environment. Supported instruments include both "passive" instruments (sensing radiated or emitted energy from the environment being observed) and "active" instruments (emitting a signal and receiving the reflected or backscattered return signal). Representative passive instruments include radiometers and spectrometers; representative active instruments include radar and lidar. Instruments may collect their data remotely, for instance, a satellite instrument that can sense forest canopy, or from within the environment ("in situ"), such as a sensor on a buoy that records ocean salinity.*	
C.3.2.90	Instruments, Sensors - Advanced/Future/Innovations
C.3.2.91	Instruments, Sensors - Anomaly Troubleshooting & Resolution, Product Impact
C.3.2.92	Instruments, Sensors - Calibration, Input Parameter Datasets, Lookup Tables
C.3.2.93	Instruments, Sensors - Characterization & Traceability to Standards
C.3.2.94	Instruments, Sensors - Compatibility, Interfaces, Integration
C.3.2.95	Instruments, Sensors - Engineering
C.3.2.96	Instruments, Sensors - Installation
C.3.2.97	Instruments, Sensors - Inter-satellite Calibration, Validation, Global Space-

	Based Inter-Calibration System (GSICS)
C.3.2.98	Instruments, Sensors - Monitoring, Performance
C.3.2.99	Instruments, Sensors - Pre-Launch, Launch, Early Orbit Raising
C.3.2.100	Instruments, Sensors - Transition to Operations
C.3.2.101	Instruments, Sensors - Validation & Verification
Technical and Scientific Service Area 2.J: Models *Services under this Service Area support models and modeling, defined as mathematical characterizations of the state of natural or engineering phenomena, typically expressed as a function of time. Models may be analytical or numerical, or include both analytical and numerical components. Due to their time dependency, models enable the study of past, present, or future phenomena states. Varying a model's input state vector supports impact studies under different, even hypothetical, conditions.*	
C.3.2.102	Models - Climate, Meteorological
C.3.2.103	Models - Cryospheric
C.3.2.104	Models - Data Assimilation
C.3.2.105	Models - Emissivity & Radiative Transfer
C.3.2.106	Models - Environmental Assessment, Monitoring, Prediction, Warnings
C.3.2.107	Models - Hydrodynamic
C.3.2.108	Models - Impact Assessments
C.3.2.109	Models - Numerical Weather Prediction
C.3.2.110	Models - Oceanographic
C.3.2.111	Models - Orbit, Conjunction Analysis
Technical and Scientific Service Area 2.K: Products (Includes any of Level 0 - 4 Processing) *Services under this Service Area support products, defined as aggregations of raw or processed data, generated to meet an enterprise goal. While NESDIS enterprise goals are not exclusively scientific, this Service Area focuses on science, engineering, and technical goals.* *Refer to https://www.ospo.noaa.gov/Products/ or https://www.ncei.noaa.gov/products for some representative NESDIS science products. NOAA processing levels are described at https://www.ngdc.noaa.gov/wiki/index.php/NOAA_Processing_Levels*	
C.3.2.112	Products - Advanced/Future/Innovations

C.3.2.113	Products - Archival Storage[6], Temporary Storage
C.3.2.114	Products - Blended (Multi-Platform, Multi-Spectral, etc.)
C.3.2.115	Products - Calibration, Validation, Verification
C.3.2.116	Products - Development Environments, Testbeds
C.3.2.117	Products - Generation
C.3.2.118	Products - Dissemination, Distribution
C.3.2.119	Products - Maintenance & Sustainment
C.3.2.120	Products - Research to Operations, Operations to Research (R2O, O2R)
C.3.2.121	Products - Stewardship & Quality Assurance
C.3.2.122	Products - Atmospheric
C.3.2.123	Products - Coastal Zone
C.3.2.124	Products - Cryospheric
C.3.2.125	Products - Land and Surface Hydrologic
C.3.2.126	Products - Meteorologic
C.3.2.127	Products - Oceanographic
C.3.2.128	Products - Space Weather
C.3.2.129	Products - Topographic, Bathymetric, Sea Surface Heights
Technical and Scientific Service Area 2.L: Requirements *Services under this Service Area support requirements to identify performance conditions or capabilities necessary for a solution to fulfill a stakeholder objective. NESDIS requirements range from the enterprise level, pertaining to NESDIS mission objectives, to programs, projects, contracts and grants. Requirements may be expressed as standards, specifications, or criteria in other forms of formal agreements.*	
C.3.2.130	Requirements - Enterprise - Databases, Tools
C.3.2.131	Requirements - Enterprise - Allocation, Definition, Derivation, Identification
C.3.2.132	Requirements - Enterprise - Management

[6] The Archival Storage Functional Entity (aka, "Archival Storage") requires contractors to provide the services and functions for the storage, maintenance and retrieval of Archival Information Packages (as defined in the Open Archival Information System (OAIS) — Reference model https://www.iso.org/standard/57284.html and https://public.ccsds.org/pubs/650x0m2.pdf).

C.3.2.133	Requirements - Enterprise - Systems
C.3.2.134	Requirements - Enterprise - Traceability
C.3.2.135	Requirements - Enterprise - Verification
C.3.2.136	Requirements - User - Applications, Data, Products
Technical and Scientific Service Area 2.M: RFI & Spectrum Management *Services under this Service Area support Radio Frequency Interference (RFI) and Spectrum Management, which comprises the analysis of sources of RFI, tactics for RFI mitigation, and the custodianship and coordination of RF spectra assignments to prevent sources of interference from using frequencies allocated to NESDIS missions.*	
C.3.2.137	Radio Frequency Interference
C.3.2.138	RF Spectrum Allocation, Utilization
C.3.2.139	RF Spectrum - Domestic, International Coordination
Technical and Scientific Service Area 2.N: Simulators & Field Experiments *Services under this Service Area support simulators. Simulators are defined as systems that provide a high fidelity imitation of the actions of platforms (satellite, aircraft, ship, autonomous vehicle), instruments, or sensors, principally as a convenience for testing. Simulators may include certain hardware components of the platform, instrument, or sensor, or implement the action model entirely in software. A simulator implemented entirely in software is sometimes referred to as an emulator.*	
C.3.2.140	Field Experiments, Observing System Experiments (OSE), Observing System Simulation Experiments (OSSE), Site Selection
C.3.2.141	Simulators - Non-Space Sensors
C.3.2.142	Simulators - Space Sensors
C.3.2.143	Simulators - Satellites and their Subsystems
C.3.2.144	Simulators - System Loading, Processing
Technical and Scientific Service Area 2.O: Systems Engineering *Services under this Service Area support systems engineering. The industry-recognized definition of systems engineering, applicable to systems engineering of NESDIS systems, is found at* https://www.incose.org/about-systems-engineering/system-and-se-definition/systems-engineering-definition.	
C.3.2.145	Systems Engineering - Standards, Specifications
C.3.2.146	Systems Engineering - Test, Integration
C.3.2.147	Systems Engineering - Risk

C.3.2.148	Systems Engineering - Requirements
C.3.2.149	Systems Engineering - Planning
C.3.2.150	Systems Engineering - System Function, Performance, Utility
Technical and Scientific Service Area 2.P: General Technical Services *Services under this Service Area support all of the above Technical and Scientific Service Areas.*	
C.3.2.151	Technical - Concepts of Operations
C.3.2.152	Technical - Documentation
C.3.2.153	Technical - Program/Project Assessments, Evaluations, Reviews
C.3.2.154	Technical - Technology Assessments, Evaluations
C.3.2.155	Technical - Forum Participation (Meetings, Symposia, Work Groups, etc.)
C.3.2.156	Technical - Statistically Designed Surveys to Support Analysis
C.3.2.157	Technical - Review Participation (Preliminary Design, Critical Design, etc.)

C.4 GENERAL DEFINITIONS

Applied Research: Applied research is an original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives.

Reference: NOAA Administrative Order (NAO) NAO-216-115, para. 09.b: https://www.noaa.gov/organization/administration/nao-216-115a-research-and-development-in-noaa

Archive and Archival definition: This term has several different meanings within NESDIS' usage. The meaning can be discerned based upon context. Two common definitions are the information technology industry use of the term, to indicate recording of data for the purposes of backup and recovery in the case of loss or corruption of the online, working copy. This is sometimes referred to as a Disaster Recovery (DR) copy. For the NESDIS/National Centers for Environmental Information (NCEI) office, Archive and Archival relate to the receipt and preservation of NOAA environmental data collections held and stewarded, by NCEI, in one or more Federal records repositories that conform to the model for an "Open Archival Information System" and adopting many of the technical recommendations for trustworthy digital repositories. The NAO 212-15 governs this latter type of Archive and Archival.

References:

https://public.ccsds.org/Pubs/650x0m2.pdf
https://public.ccsds.org/pubs/652x0m1.pdf
https://nosc.noaa.gov/EDMC/nao_212-15.php

Calibration: Calibration is a comparison between a known quantity or standard and its corresponding measured or sensed quantity. The concept generalizes to software, with algorithmic parameters or coefficients calibrated or "tuned" to generate a result that conforms to some calibration standard.

Data Management - consists of two major activities conducted in coordination: data management services and data stewardship. They constitute a comprehensive end-to-end process including movement of data and information from the observing system sensors to the data user. This process includes the acquisition, quality control, metadata cataloging, validation, reprocessing, storage, retrieval, dissemination, and archival of data.

Data Management Services - a subset of Data Management and includes adherence to agreed-upon standards; ingesting data, developing collections, and creating products; maintaining databases; ensuring permanent, secure archival; providing both user-friendly and machine-interoperable access; assisting users; migrating services to emerging technologies; and responding to user feedback.

Data Stewards - individuals who are responsible for establishing, maintaining, and being accountable for the quality, integrity, documentation, and preservation of environmental data. This responsibility extends from the Assistant Administrator down to the individuals who are most directly involved with the environmental data.

Environmental Data - Recorded and derived observations and measurements of the physical, chemical, biological, geological, and geophysical properties and conditions of the oceans, atmosphere, space environment, sun, and solid earth, as well as correlative data, such as socio-economic data, related documentation, and metadata. Media, including voice recordings and photographs, may be included.

Environmental Intelligence: Actionable (i.e., decision-quality) information created by collecting (measuring/observing), compiling, exploiting, analyzing data to characterize the state of the natural environment at a given location or spatial region and time (past, present, future).

Reference:
https://ams.confex.com/ams/96Annual/webprogram/Handout/Paper288243/AMS_Jan2016_HaNCEI_Final.pdf

Observing System: One or more sensing elements that directly or indirectly collect biological, physical, chemical, and/or socioeconomic observations of the Earth and space. Sensing elements may be deployed as individual sensors or in constellations and may include instrumentation or manual observations. Observing system platforms may be mobile or fixed and may be located in atmospheric, freshwater, marine, space, or terrestrial environments.

Reference:
NOAA Technology, Planning and Integration for Observation division (TPIO) Glossary; https://nosc.noaa.gov/tpio/main/glossary.html

Preservation: Processes and operations involved in ensuring the technical and intellectual survival of records through time. Ref. NOAA Procedure for Scientific Records Appraisal and Archive Approval National Oceanic and Atmospheric Administration Guide for Data Managers, August 15, 2008, Section 4.

Research to Operations: The NOAA process for taking applied research results and incorporating them into routinely provided, sustained, mission products and services (a.k.a. "operations").

Reference: https://www.noaa.gov/organization/administration/nao-216-105b-policy-on-research-and-development-transitions

Survey: Depending upon the context in which it is used, this term can have different meanings within NESDIS. Some meanings, determinable by context, are: a formal land survey (as required in planning for a new climate monitoring station construction project); a scientific measurements collection and mapping activity (in fulfillment of hydrographic survey objectives); an inspection and assessment of mission equipment (or other items) activity; a data collection activity for social science and/or economic research purposes (as in an opinion poll).

Stewardship: Stewardship often means either "data stewardship" or "scientific data stewardship", as determinable by context.

Data Stewardship: Outlined in https://nosc.noaa.gov/EDMC/nao_212-15.php
Ref. section 6. As follows: "A subset of Data Management and consists of the application of rigorous analyses and oversight to ensure that data sets meet the needs of users. This includes documenting measurement practices and processing practices (metadata); providing feedback on observing system performance; inter-comparison of data sets for validation; reprocessing (incorporate new data, apply new algorithms, perform bias corrections, integrate/blend data sets from different sources or observing systems); and recommending corrective action for errant or non-optimal operations."

Scientific Data Stewardship: Ref: A Unified Framework for Measuring Stewardship Practices Applied to Digital Environmental Datasets
https://datascience.codata.org/articles/10.2481/dsj.14-049/galley/16/download/
https://www.ncdc.noaa.gov/news/addressing-scientific-data-stewardship-challenges

Validation: Assessment of engineering, scientific, or technical fidelity. The several instances of validation throughout the PWS indicate that validation occurs at all scales ranging from individual data to products and algorithms, to systems operations, such as uplinking a satellite

command load. Validation does not imply verification: a validated system may produce a scientifically accurate result, yet it may not meet the system's accuracy requirements.

Verification: Assessment of compliance with requirements and specifications. The several instances of verification throughout the PWS indicate that verification occurs at all scales ranging from individual data to satellite constellations. Verification does not imply validation: a system's verified ability to timely generate a product does not imply the correctness of that product.

(End of Section C)