Earthquake Science Center Science and Technical Services Support (ESATS)

Statement of Work (SOW)

A. INTRODUCTION

General Background

The Earthquake Science Center (ESC) is home to earthquake hazard and mitigation research as well as several ground motion monitoring and earthquake notification efforts – the Earthquake Notification Service (ENS), the National Strong Motion Project (NSMP), the Northern California Seismic Network (NCSN), the Pacific Northwest Seismic Network (PNSN), the Southern California Integrated Geodetic Network (SCIGN), the Southern California Seismic Network (SCSN), Operational Aftershock Forecasting (OAF), Induced Seismicity, and the USGS ShakeAlert Earthquake Early Warning Project (EEW). These scientific and monitoring efforts collaborate closely with university partners in their respective geographic regions. These combined efforts advance scientific research in numerous fields of seismology, geodesy, and geophysics. Collectively they operate more than 2000 ground motion monitoring stations, over 200 telemetry relays, and several data collection and analysis centers. Field data is telemetered in near real time to collection and analysis centers, where geophysical software creates and distributes a variety of products based on the data received. The field data is also archived and used for research projects, which advance the state of the art in seismology, geodesy, and geophysics and is used to improve monitoring efforts and products. These combined research and monitoring efforts provide earthquake monitoring and hazard mitigation to a geographic region containing over 50 million people and help prepare for expansion of earthquake early warning into other areas. In addition, these efforts have substantial impact on earthquake monitoring and notification standards and methods across the USGS Advanced National Seismic System and provide earthquake response products used both nationally and globally.

Contract Background

This will be an Indefinite Delivery / Indefinite Quantity (IDIQ) contract for a broad range of services where the scope includes, but is not limited to scientific software development, data science, full stack dev/ops, network engineering, cybersecurity, and systems administration services and support for scientific monitoring systems as described in the general service areas listed herein. Under the IDIQ contract, individual Task Orders (TOs)

covering specific software, science, or IT related services will be issued for various tasks within the general scope of this statement of work. These individual TOs will specify the nature of the work, the objectives, the desired results of work performed, milestone schedule(s), and similar task requirements to be accomplished, along with applicable metrics used to evaluate successful performance for the TO at hand.

Contract Type

Task Orders will be issued on a Performance-Based Firm-Fixed Price (FFP) basis.

B. CONTRACTOR REQUIREMENTS

The scope of the contract activities will encompass scientific software development, data science, and scientific monitoring systems-related IT across ESC. While specific tasking will be detailed in individual task orders issued against this contract, the general scope of the support activities that could be or may be ordered is described throughout this Statement of Work. The Contractor shall provide the capacity, capability, and resources necessary to perform and manage all the technical and management activities required for successful and timely completion of task orders issued under this contract.

C. SCIENTIFIC AND TECHNICAL SERVICES REQUIRED

The Contractor shall provide non-personal services in the following service areas to various organizational units of the ESC as specifically defined in individual task orders. As currently established, the needs of ESC are represented in the four major subparagraphs in this Section C (C.1, C.2, C.3, and C.4). While these Section C requirements are organized in this way for convenience, there is overlap between and among the ESC's scientific software packages, ground motion monitoring networks, data science projects, and research projects. Task orders may reflect this.

The types of scientific software development, data science projects, research support, and information technology services to be ordered under this IDIQ contract include, but are not limited to: scientific software maintenance, operations, and development; scientific data and information management and analytics; computer system administration in support of scientific research and ground motion monitoring networks; technical applications engineering; database design and development; full stack Dev/Ops engineering; and computer network engineering in support of scientific research and ground motion

monitoring networks. All work will be performed in Linux/Unix environments that are subject to US Government cybersecurity and other regulations (OWASP Top 10 and federal mandates, e.g. FISMA, NIST SP 800-53, etc.).

It should be noted that as an IDIQ contract, the exact description of the scientific software, data science projects, research support, and IT services to be ordered is, by design, indefinite. When this Statement of Work (SOW) uses the phrase "the contract may require", or "services may be ordered", or other similar phraseology, the intent is that the listing or recitation of services or functions that follow are typical examples of the services that may be ordered, not a limitation on the services to be ordered. In addition, generally when a list of tools or software development languages appears (e.g., "Python, C++, Django, etc." or "ActiveMQ, NATS, etc.") these listings are also considered to be typical examples, rather than exhaustive lists or limitations.

C.1. Scientific Application Services

Task order requirements in the scientific application services area may include:

C.1.1 Scientific Software Development – Requires expertise and contractor staff support for the entire software development life cycle from the requirements, design, and implementation stages to maintenance, performance analysis, and technical support functions for geophysical software applications (both research and operational). Maintain and upgrade existing applications, as well as design and write new applications using the appropriate languages (e.g. Python, C++, Java, etc.). Migrate scientific software packages to the USGS Cloud Hosting Solutions (CHS) environment. Prepare documentation for technical and scientific applications; prepare code level test plans, develop data to test code changes, and perform parallel tests of old and modified systems. Most geophysical software applications used at the ESC require a deep knowledge of seismology, geodesy, geophysics, mathematics, or physics for proper bug detection and fixing, as well as analysis of code results for scientific soundness.

C.1.2 Scientific Application Support – Requires expertise in operation and performance analysis of scientific computer systems sufficient to perform the following functions: scientific application configuration, application backup, software installation and maintenance, software license maintenance, analysis of server utilization and application performance; execute security audits to ensure compliance with established USGS policies; system administration, resource management, and systems analysis to ensure efficient use of computing resources.

C.1.3 Database Development and Integration – Requires knowledge of database integration standards such as RESTful APIs and ETL pipelines, database architectures such as MongoDB, MySQL, PostgreSQL, SQL, and NoSQL solutions, along with cloud-native services (e.g. AWS RDS, Azure SQL, etc.). Services required may include software installation, maintenance, enhancements to existing databases, troubleshooting, performance tuning, capacity planning and resource management, setup of new database instances from data design documents, the development of new and modified database implementation designs, development of user interfaces, database system administration tasks including access controls and IT security, maintenance of inventory of database software licenses, development and administration of data management applications software and associated tools; advise on software technology and database design as they relate to project needs; design enhancements to databases, applications, and services; provide support and coordination in loading, configuring, operating, maintaining, optimizing, scaling, replicating, and upgrading database supporting software.

C.1.4 Message-Oriented Middleware – Requires expertise in installing, configuring, administering, and maintaining Message-Oriented Middleware (MOM) platforms—such as ActiveMQ, NATS, Kafka, and other industry-standard MOM solutions—to enable reliable, scalable, and secure messaging for complex scientific monitoring systems. Services required may include: ensuring seamless integration of MOM platforms with existing scientific applications, telemetry systems, and distributed data pipelines; supporting interoperability across heterogeneous environments including the CHS cloud; designing and implementing MOM configurations which support high-throughput, low-latency messaging for real-time seismic and geodetic data processing; optimizing, load balancing, and fault tolerance to maintain resilience under peak loads; applying best cyber security practices for MOM platforms; and implementing robust monitoring and alerting tools to track message flow, latency, and system health. All MOM operates within a 24/7 scientific data acquisition, analysis, and product generation environment. Work must not only support this environment but minimize disruption to it while ensuring resilience, fault tolerance, and scalability for mission-critical seismic and geodetic data messaging and products.

C.1.5 Full –Stack Development – Requires advanced knowledge of front-end and back-end development for scientific web applications. Services shall include building new scientific software applications and maintaining and improving existing ones using modern

frameworks; ensuring responsive design and cross-platform compatibility for scientific applications; developing interactive visualization tools to analyze, interpret, and display real-time seismic, geodetic, and other geophysical data; implementing secure coding practices aligned with OWASP Top 10 and federal mandates (e.g. FISMA, NIST SP 800-53, etc.); integrating role-based access control, TSL encryption, and secure authentication mechanisms; optimizing applications for high-performance rendering and analysis of large geophysical datasets; supporting cloud-native deployments and containerization for scalability and fault tolerance; and incorporating automated unit and integration testing into Continuous Integration / Continuous Delivery (CI/CD) pipelines for continuous delivery and quality assurance.

C.1.6 DevOps – Requires advanced knowledge of software deployment, infrastructure management, and Continuous Integration / Continuous Delivery (CI/CD) pipelines to support mission-critical scientific applications. Services required may include: developing and maintaining automated deployment scripts for provisioning and configuration management; implementing automated deployment of distributed systems – including MOM superclusters – across geographically distributed AWS and Azure environments for resilience and scalability; utilize containerized deployments, ensuring portability, fault tolerance, and efficient resource utilization; integrating secure CI/CD pipelines, enabling automated builds, unit testing, integration testing, and deployment; incorporating static and dynamic security testing (SAST/DAST) and vulnerability scanning into the pipelines; applying DevSecOps principles to embed security controls throughout the deployment lifecycle; implementing monitoring and alerting solutions for real-time visibility into system health, performance, and deployment status; and designing and implementing rollback strategies and disaster recovery procedures to maintain high availability and minimize downtime during deployments.

C.1.7 On-call requirement – Since the Earthquake Science Center's ground motion monitoring networks operate 24/7/365, some task orders may have an on-call requirement in which the incumbent participates in a 24/7 duty rotation shared with Government employees and University partners. Each duty cycle lasts 1 week (usually Wednesday to Wednesday), and all members of the duty pool work together to ensure that everyone's scheduling needs are met. Being on call requires carrying a cell phone to receive and respond to system notifications or earthquakes. Specific response times will be indicated in the task order if on call duties are required for that task.

C.2. DATA SCIENCE AND ANALYTICS

In general, this service area supports scientific research, data product development, and research dissemination by providing data science expertise, analytical methods, and advanced computational capabilities consistent with federal and USGS requirements. Task order requirements in the data science and analytics area may include:

C.2.1 Data Stewardship and Preservation – Requires advanced knowledge of scientific data and metadata collection, management, preservation, and curation. Services required may include: Data management planning; metadata creation and data integration; provenance tracking and version control; ensuring consistency and non-duplication in the areas of data management plan development and approval and maintenance and archiving of research project data; following USGS Fundamental Science Practices (FSP), Records Management, and other federal directives which require management and preservation of research data and metadata through the entire lifecycle – planning, acquiring, processing, analyzing, preserving, curating, publishing, sharing, documenting, managing quality, securing, and archiving.

C.2.2 Data Analytics – Requires advanced knowledge of mathematics, statistics, and empirical analysis, as well as expert critical thinking and technical communication skills to support scientific research, develop analytical interpretations, and communicate findings to technical audiences. Services required may include: Employing empirical and process-based methods to execute segments of research questions; planning, developing, and applying analytical models in support of research questions; preparing and integrating data while maintaining reproducible preprocessing workflows and documentation; planning, developing, and applying empirical and statistical models, assessing model performance, and documenting uncertainty analyses and modeling assumptions; developing data visualizations and analytic summaries which clearly communicate findings to scientific and technical audiences; conducting sufficient writing and summarization to support written products that convey research-based knowledge and information to technical audiences; and applying data science techniques and appropriate methods towards prediction, reproducibility, model evaluation, and communication.

C.2.3 Machine Learning, Deep Learning, Natural Language Processing – Requires advanced knowledge of and facility with modern computational and modeling methods, as well as significant programming skills. Services required may include: Employing the methodologies of machine learning, deep learning, and natural language processing to complex data management and analysis problems in support of scientific research and scientific data products; developing and implementing new computational tools, novel architectures, statistical and mathematical modeling approaches, machine learning algorithms, and advanced concepts of automation and information processing in support

of advanced data management analysis capabilities; defining model evaluation criteria, documenting data specifications, developing risk assessments, training models, and establishing traceability to enable full reconstruction of the training and evaluation process; conducting model performance evaluation, fairness analyses, and validation; developing and implementing automation frameworks which promote computational efficiency, reproducibility, and scientific data processing and analytics capabilities.

C.2.4 Artificial Intelligence Integration – Requires advance knowledge of and facility with modern and emerging computational and modeling methods, as well as significant programming and critical thinking skills. Services required may include: Employing artificial intelligence (AI) frameworks and methodologies to design, develop, and deploy custom and off-the-shelf AI agents and associated workflows in support of scientific research, data management, and operational mission objectives; integrating generative and agentic architectures, based on Large Language Models (LLMs), Convolutional Neural Networks (CNNs), and other machine learning models, into existing scientific and data management pipelines to enhance analytical capability, reduce manual burden, and accelerate knowledge synthesis; developing and configuring domain-specific AI agents and agentic AI processes capable of autonomous task execution, multi-step reasoning, tool use, and adaptive decision-making within defined operational parameters; applying prompt engineering, fine-tuning, and model evaluation techniques to ensure AI outputs are accurate, reproducible, and aligned with scientific and federal data standards; assessing, documenting, and mitigating risks associated with AI system outputs including hallucination, bias, and data provenance concerns, consistent with applicable federal AI governance policies, agency directives, and responsible AI principles.

C.3. Scientific IT Infrastructure Services

Task order requirements in the IT infrastructure services area may include:

C.3.1 System Administration – Requires advanced knowledge of systems administration and a solid understanding of the impact of IT infrastructure on science applications. Work is done in a Linux/UNIX environment and in the context of ground motion monitoring networks or support of geophysical research, product development, and applications. Services required may include: Monitoring computer systems for availability, intrusion detection, and operating system performance; researching, developing specifications, recommending, designing, building, and managing hardware and software components of the system including new software installs and software upgrades; installing operating system patches, managing user accounts, and monitoring

storage subsystems; and establishing and maintaining system documentation to include hardware and software inventories, diagrams and configurations, procedures (for installation, disaster recovery, configuration management, and standard operating procedures), user guides, and scripts.

C.3.2 IT Security Support – Requires advanced knowledge of cyber security principles and implementations. Services required may include: Providing comprehensive cybersecurity services to ensure compliance with the Office of Management and Budget (OMB) Circular A-130, the Federal Information Security Modernization Act (FISMA), and other applicable federal mandates. This includes maintaining and updating Assessment and Authorization (A&A) documentation and artifacts such as Cyber Security Assessment and Management (CSAM) records and ensuring timely closure of outstanding Plan of Action and Milestones (POA&Ms). Reviewing and remediating vulnerabilities identified by enterprise vulnerability management tools, conducting Static Application Security Testing (SAST) and Dynamic Application Security Testing (DAST), and integrating these practices into CI/CD pipelines for continuous assurance. Additionally, configuring and implementing security controls in accordance with NIST SP 800-53 Rev. 5, DISA STIGs, and CIS Benchmarks, while developing strategies to address Zero Trust Architecture, CHS Cloud Computing security, and other emerging government directives. Responsibilities also include monitoring and optimizing security postures using Security Information and Event Management (SIEM) tools, executing incident response procedures, and applying cybersecurity best practices specific to scientific monitoring systems.

C.3.3 On-call requirement – Since the Earthquake Science Center's ground motion monitoring networks operate 24/7/365, some task orders may have an on-call requirement in which the incumbent participates in a 24/7 duty rotation shared with Government employees and University partners. Each duty cycle lasts 1 week (usually Wednesday to Wednesday), and all members of the duty pool work together to ensure that everyone's scheduling needs are met. Being on call requires carrying a cell phone to receive and respond to system notifications if needed.

C.4. Telemetry Support

Task order requirements in the telemetry support services area may include:

C.4.1 Computer Networking and Network Administration support – Requires advanced knowledge of modern networking equipment and protocols and a solid

understanding of the impact of telemetry infrastructure on scientific data acquisition and science applications. Work is done in the context of ground motion monitoring networks and in support of geophysical applications and product generation and distribution. Services required may include: Maintaining routers, switches, firewalls and other network related appliances; analyzing, designing, and installing local area networks (LAN), wireless LANs (WLAN), and wide area networks (WAN); establishing network services such as SSH, DNS, DHCP, DHCPv6, SSL, etc.; installing new system application software and software patches on networking appliances; performing system backups, load monitoring, and implementing hardware and / or software upgrades for networking devices, network servers and workstations; analyzing and troubleshooting network hardware and applications; and making recommendations for equipment procurement, removal and modifications of network devices. Systems are interconnected with geophysical ground motion monitoring devices in remote geographic locations. Systems may be interconnected with or connected to partner systems that employ software defined networking (SDN), seamless access, and zero trust networking. This requires expert knowledge of but not limited to: geophysical instrumentation configuration and communication protocols (e.g. those of Kinemetrics, Nanometrics, RefTek, Trimble, etc.); LAN, WLAN, and WAN configurations; Internet Protocols version 4 (IPv4) and version 6 (IPv6); and TCP, UDP, and ICMP.

C.4.2 Device Configuration support – Requires advanced knowledge of device configuration procedures for network-capable geophysical instrumentation. Services required may include: Configurating network-capable geophysical instrumentation in preparation for field deployment (e.g., Kinemetrics, Nanometrics, RefTek, and Trimble devices); integrating new geophysical instrumentation into established data telemetry and acquisition infrastructure, including using modern communications and data acquisition protocols for ground motion monitoring equipment.

C.4.3 On-call requirement – Since the Earthquake Science Center's ground motion monitoring networks operate 24/7/365, some task orders may have an on-call requirement in which the incumbent participates in a 24/7 duty rotation shared with Government employees and University partners. Each duty cycle lasts 1 week (usually Wednesday to Wednesday), and all members of the duty pool work together to ensure that everyone's scheduling needs are met. Being on call requires carrying a cell phone to receive and respond to system notifications if needed.

D. SAMPLE MEASURES AND METRICS FOR EVALUATION OF TASK PERFORMANCE

Specific performance measures and metrics will be included in each task order and tailored according to the nature of the task order, and consistent with the contractor's standard methods and procedures used to manage the level of service and quality of services they provide to their customers (e.g., Quality Control Program – see Section E). The Contractor may be asked to provide recommended performance measures or metrics applicable to the particular task order proposal. Performance measures may include written summary reports, and/or periodic status or project review meetings. Examples may include items such as:

D.1 Periodic Status Reports may be required depending on the task order. To the extent possible, it is anticipated that informal reports and / or status summaries may be sufficient to keep the Government appraised or progress, problems, issues, and funding status, etc. Information which may be required could include:

D.1.1 Program Status Reports, to provide status comparing and detailing the program's actual status against the approved task plan, and typical reports containing information such as:

- Task order number
- Brief summary of accomplishments achieved during the reporting period
- Brief summary of accomplishments planned for the next reporting period
- Deliverables status (submitted and / or progress)
- Any major decisions made regarding the task order during the reporting period
- Any current and / or anticipated issues that may affect task progress
- Any current and / or anticipated risks, and possible mitigation statement or assessments

D.1.2 Budget or Financial Reports. As requested in the Task Order (TO) and depending on the type of order or complexity of the TO, these reports may include cumulative invoicing by labor category, or by task or subtask. Other examples may include spend vs planned budget, burn rate by task or subtask, percent completed vs. percent budget used, cumulative funds spent, and similar common report formats or spreadsheets to support the electronic invoice process.

D.1.3 Staffing. Reports on current or projected staffing issues or challenges, summary plans and progress of mitigation plans, recruitment activities, projected staffing levels and plans to achieve same, progress against goals or plans, etc.

E. QUALITY CONTROL REQUIREMENTS

E.1 The Contractor shall utilize its company procedures (e.g., Quality Control Program) to monitor and manage the quality of the services provided and to ensure that the requirements of the contract and each task order are provided as specified. At the time a task order is proposed, and as may be applicable, the Contractor will propose suitable performance measures for each task order that will be utilized to measure the standards of work or some acceptable quality level of the services to be provided for the task at hand. These measures may include minimum requirement standards, performance output measures, methods of measuring the quality of services provided, performance indicators, corrective actions, etc. Acceptable quality levels and methods of measuring will be established in each task order, tailored as necessary to the applicable activities.

E.2 The Contractor is responsible for implementing their quality programs, as applicable to the overall contract and the individual task orders, and the Government will conduct and document surveillance activities on the contractor's program. The contractor is responsible for collecting their own metrics, managing their performance levels, and reporting these activities to the Government. As part of the Government's surveillance activity, Government representatives responsible for monitoring Contractor performance will be kept abreast of the reporting, monitoring, and corrective actions (if any) being taken by the Contractor under its Quality Control Program. When performance falls below acceptable quality levels as defined in each task order, the designated Contractor manager or Task Lead will be notified for appropriate corrective action to be taken.

F. CONTRACT / TASK MEETINGS

The Contractor representative, as defined in Section G below and / or alternate shall be required to meet, at the discretion of the Contracting Officer (CO), Contracting Officer's Representative (COR), and / or federal technical lead or Task Order Manager (TOM) during the term of the contract. The Contractor may request a meeting with the CO, COR, and / or TOM when the Contractor deems necessary. These meetings may be on an ad hoc or regular recurring schedule at the option of the CO, COR, and / or TOM, or as specified in individual task orders.

G. RESERVED

H. MANAGEMENT AND STAFFING

H.1 Professional and highly skilled technical and scientific personnel are major factors in the successful performance of this contract. The Contractor shall provide fully qualified staff capable of producing the required outcomes and results for meeting the specific performance standards of each task order. Contractors shall have the knowledge, skills, currency, and applicable certifications necessary to perform the required services in the task orders. The Contractor shall provide any necessary administrative, managerial, and supervisory capabilities associated with the effective performance of the contract activities. Where applicable, on-site representative(s) of the contractor such as a Task Leader will perform supervision and will be responsible for the monitoring or progress, quality, and conduct of the work assignments of the Contractor personnel. At no time shall the Government supervise Contractor personnel. The Task Leader responsibilities is not a full-time position; it may be included as collateral duties or proposed in a different fashion. The Task Leader will also coordinate after hour work or necessary support in case of an emergency in coordination with the COR and / or federal TOM.

H.2 The Contractor shall provide fully trained personnel, be required to have an ongoing training program, and be responsible for their personnel acquiring the knowledge and skills necessary to support new technologies, facilitate scientific advances, and maintain subject matter currency. Where advantageous to the Government, training may be provided by the USGS at no cost to the Contractor. The Government will provide training exclusively for tasks that require knowledge of the systems unique to the USGS.

H.3 The Contractor shall maintain the Management and Staffing Plan (first prepared and submitted with their proposal) which clearly indicates which personnel will fulfill the contract-level Key Personnel roles, and how task-level staffing will be managed, performance will be monitored, and key personnel will be designated and managed. Plan revisions shall be submitted as necessary. The Contractor's management and staffing activities would be expected to correspond to the stated procedures and actions called for in its then current Plan. It is likely that there will be a number of task orders in place at any given time, being performed concurrently. A staffing matrix will be maintained which specifies the labor categories assigned to the various active task orders, key and non-key personnel, their roles, authorities, accountability, summary of areas of expertise, and locations. The matrix will be submitted monthly. The contractor should identify potential cost savings to the Government where any redundancies or duplications may be evident through the matrix (e.g., instances where related or similar labor categories are involved in multiple task orders for similar activities).

H.4 Key Personnel: It is expected that staffing and work assignment decisions, or key personnel designations, will largely be taken at the task order level and based on the specific requirements of the applicable task order. Where a task order or activity may require the specific expertise and skills of a particular person or subject matter expert, the task order request, and / or the task order proposal will identify this need. Once designated, the provisions of the Key Personnel clause will apply to the named individual(s). Contract-level Key Personnel will be named in the contract's Key Personnel clause (if applicable); while task order-level Key Personnel will be named in the task order. In either case, the provisions of the contract's Key Personnel clause will apply.

I. RESERVED

J. EXPERIENCE AND CAPABILITIES

Contractor experience, capability, and capacity to provide personnel with the appropriate experience, education, training, skill set, etc. are important to the success of this contract activity. The contract requires the capacity to provide services to a mid-size, geographically dispersed organization. Skills are required to support the broad and diverse universe of scientific software development and support, geophysical research and applications support, data science and analytics support, and IT services. The Contractor must have demonstrated experience, capabilities, and capacity to provide the necessary services and skills covering the full breadth of this requirement.

This section provides information relating to the background of services provided under prior support contract(s), and information about essential elements for the successful contractor and associated workforce considered to be necessary going forward under this contract. This information is based upon prior USGS contract(s), as well as the Earthquake Science Center's current expectations for the needs under this contract.

J.1 Examples of Common Activities and Expertise

Examples of common activities and expertise utilized on other USGS contracts are listed below. This is not an all-inclusive listing, and it is not necessarily indicative of what will occur on this new contract. The listing is provided for illustrative purposes and to provide offerors an example of some of the principal functions and expertise that has been utilized on prior scientific software, research and technical support, and IT services contracts:

- **Scientific Algorithm Developer**
  Developers must have deep knowledge of seismology, geodesy, geophysics, mathematics, or physics, as well as production-level software development skills for scientific applications.
- **Data and Information Science Specialist**
  Data and information science specialists must have the ability to apply machine learning, deep learning, and advanced analytics for seismic and geophysical datasets. In addition, they must have sufficient knowledge of seismology, geodesy, geophysics, or physics to interpret results, assess results for scientific soundness, and write summaries for a high-level scientific audience.
- **Cloud Developer**
  Cloud developers must have experience with cloud-native architectures, containerization (e.g. Docker, Kubernetes, etc.), and hybrid deployments for scientific workloads.
- **DevOps Engineer**
  DevOps engineers must have expertise in CI/CD pipelines, automated testing, infrastructure as code (IaC), and secure deployment practices.
- **Linux System Administrator**
  System administrators much have advanced skills in Linux hardening (DISA STIGs, CIS Benchmarks), SELinux/AppArmor configuration, patch management, and audit logging.
- **Network Engineer**
  Network engineers much have advanced knowledge of TCP/IP protocols (IPv4 & IPv6), OSPF, BGP, SDN, and secure network design for telemetry systems.
- **Database Administrator and Developer**
  Database administrators and developers must have experience with relational (e.g. SQL) and NoSQL databases (e.g. PostgreSQL, MongoDB), ETL pipelines, and cloud database services (e.g. AWS RDS, Azure SQL).
- **Development, Security, and Operations (DevSecOps) Specialist**
  DevSecOps specialists must have advanced knowledge of integration of cybersecurity best practices into software development, including secure

coding standards (e.g. CERT C++), fuzz testing, Software Bill of Materials (SBOM) management, and compliance with FISMA/NIST requirements.

J.2 Current Environment

The ESC and its University Partners operate both stand-alone and integrated server systems located in geographically separated locations as well as in the Amazon Web Services cloud. Communications protocols between servers must meet both DOI and University IT requirements. This distributed system is tuned to optimize ground motion monitoring, scientific data analysis, geophysical research efforts, and hazard mitigation product generation and distribution, all within a cybersecurity environment that crosses many jurisdictions.

J.2.1 Hardware utilized includes but is not limited to:

- Cisco
- Dell
- Kinemetrics
- Nanometrics
- Palo Alto Networks
- YubiCo

J.2.2 Software includes but is not limited to:

- ActiveMQ
- Ansible
- AQMS (ANSS Quake Management System)
- AWS RDS
- Azure SQL
- Bootstrap
- Caddy
- Clang Static Analyzer
- Cloud Formation
- Coverity
- D3.js
- Django
- Docker
- ENS (Earthquake Notification System)

- FastAPI
- FaultMod
- Flask
- Git
- GitHub
- GitLab
- Grafana
- Kafka
- Kubernetes
- Lambda
- Mithril.js
- MongoDB
- Nagios
- NATS
- NoSQL
- opensha
- opensha-oaf
- PDL
- Plotly
- PostgreSQL
- Podman
- Prometheus
- RabbitMQ
- React
- Redis
- ShakeAlert
- Slurm
- Vue
- YubiKey

J.3 **Experience and Skills**

The Contractor shall staff appropriately to accomplish the outcomes defined by the contract and the assigned task orders. Experience, skill sets, and support capabilities listed below are considered necessary and essential to perform the breadth and scope of this contract's requirements. Skills the Contractor and its assigned personnel are expected to possess include but are not limited to:

- Seismology, Geodesy, Geophysics, and/or Physics
- Statistics and Analytics
- Full Stack Development for scientific applications
- Red Hat Enterprise Linux and other Linux distributions
- High- and low-level programming languages (e.g. C, C++, Go, Java, Python, etc.)
- Scripting languages (e.g. bash, sh, zsh, Ruby, Python, Matlab, Octave, etc.)
- Container technologies and orchestration (e.g. Docker, Kubernetes, Podman, etc)
- Transport Layer Security (TLS) encryption
- TCP/IP (IPv4 & IPv6) environment and protocols such as OSPF, BGP, and spanning tree protocols
- Cloud computing such as Amazon Web Services and hybrid architectures
- Infrastructure as Code (IaC)
- High performance computing (HPC) environments
- Managing remote servers not physically co-located with administrators
- Interconnection of scientific instrumentation in the field with scientific data processing algorithms in the data center
- Amazon services (e.g. SES, Cloud, EC2, S3, IAM, Route 53, SNS, FSx, OpenZFS, etc.)
- FISMA/NIST security requirements and DISA STIG compliance
- DevOps and Continuous Integration and Continuous Delivery (CI/CD) software development methodologies
- IT Security, including secure coding practices, vulnerability remediation, and compliance monitoring

K. PLACE OF PERFORMANCE – MULTIPLE LOCATIONS

This requirement is to provide information technology support services for the entire ESC operation. Some work may be conducted at the contractor's own facilities, but it is anticipated that a considerable amount of the required support services will be provided either remotely or at one or more USGS facilities. The principal locations of the on-site

USGS services include, but are not limited to Pasadena, CA; Moffett Field, CA; and Seattle, WA. As operations expand, additional on-site USGS locations may be folded in.

L. REQUIRED HOURS OF SERVICE (OTHER THAN ON-CALL) AND TELEWORKING

Support is required to be provided Monday through Friday during normal business hours. While the Contractor will have its own facilities and work locations, it is expected that a number of the Contractor's employees providing support services to the ESC will be required to be physically present at the government facility which they are supporting. Task orders will indicate if Contractor personnel's presence is desired or required in particular instances.

If the Contractor's internal policies and procedures permit telework for its personnel, the Contractor may be permitted to allow telework depending on the particular requirements of the applicable task order(s). Where appropriate and pre-approved (on a task order-by-task order basis), Contractor personnel may engage in telework where the support services being provided are not disrupted, delayed, or impacted. Such arrangement may be inappropriate where physical presence of personnel is deemed necessary; where insufficient oversight opportunities exist, on T&M (LH) task orders, or where significant on-site collaboration to accomplish task objectives is necessary. Where applicable, the Contractor shall propose the telework arrangement to be utilized relative to each applicable task order at the time of submitting the task order proposal; and the government will evaluate the relative merits to the government and approve the arrangement on a task order-by-task order basis.

M. TRAVEL

It is anticipated that little or no travel would be required or would be necessary as a direct cost of contract performance. Where necessary, the Contractor shall be reimbursed for actual transportation costs and travel allowances of Contractor employees in accordance with the travel cost principle in FAR 31.205 and Federal Travel Regulations. Charges exceeding the amounts established in the Government Travel Regulations for individuals engaged in comparable functions may be disallowed as unreasonable unless approved in advance by the Contracting Officer.

N. GOVERNMENT FURNISHED DOCUMENTATION

USGS, DOI, and University Partner documentation necessary to support the task orders will be provided as necessary by the Government.

O. GOVERNMENT FURNISHED PROPERTY

The Government shall provide, without cost, the facilities, equipment, materials, and services listed below or as listed in task orders. The Government furnished property and services provided as part of this contract shall be used only by the Contractor and only to perform under the terms of this contract. No expectation of personal privacy or ownership using any USGS electronic information or communication equipment shall be expected. Use of Government facilities is expected to be limited to activities associated with performing the requirements of this contract (or, if applicable, related USGS contracts).

O.1. The Government shall provide facilities (office space) within government facilities in support of various task orders as may be required. Contractor staff may be required at any USGS location depending upon the task order. Use of the facilities by contract employees will be subject to the access and usage rules of the particular facility, and provided workspace would consist of typical workspace areas and amenities (e.g. cubicle, workstation, etc.) that would be typical of the type of work being conducted. If other facilities are to be used, the Contractor will be notified in writing.

O.2. Equipment. The Government shall provide the following (when applicable):

O.2.1 A suitable working environment (i.e. office furniture and administrative supplies).

O.2.2 A personal computer (or laptop) with access to appropriate Government and University Partner networks necessary to perform task order workload, as well as auxiliary hardware and software required in the performance of this contract.

O.2.3 Other IT or communications equipment as deemed necessary or when determined to be applicable by the COR and/or federal Task Order Manager (TOM). The Government will replace items that are determined by the COR /TOM to be beyond economical repair unless damage or loss is due to Contractor negligence.

O.3. Material. The Government shall furnish basic reference manuals, and any revisions, updates, and changes thereto for use by the Contractor. Note that most geophysical software applications and some of the ground motion monitoring equipment are custom, so manuals are generally not available. Access to appropriate documentation, wikis, etc will be provided by the Government when such materials exist.

O.4. Use of Government Property.

- Telephones / Cell phones. Government telephones and cell phones are provided for use in conducting official business. Occasionally, Contractor employees are permitted to make calls that are considered necessary in the interest of the Government. In addition, Contractors with on-call duties related to an on-call duty rotation will be given the option of either carrying a government-issued cell phone or using their personal phone so they may be reached while on call outside of regular business hours.
- Mail / Postage. Contractor employees shall not have their personal mail directed to Government office or use Government-furnished postage for personal benefit.
- Electronic Mail (E-mail). All e-mail access and use by Contractor employees shall be in support of the individual's official duties and task responsibilities. All information created, transmitted, received, obtained, or accessed in any way captured electronically using USGS e-mail systems is the property of the Government. Contractor employees will have a clear identification in their e-mail signature block that identifies themselves as contract employees in support of the USGS.
- Copiers. Copiers are to be used to copy material for official Government business only in performance of the task.
- Computers and the Internet. All Internet and electronic media access accomplished by Contractor employees (utilizing Government furnished equipment) shall be for official Government business and in support of task requirements. Use of Government furnished computer systems for personal use is prohibited.

O.5. Return of Government Property. All Government property, data, information, etc., used by the Contractor in conjunction with performance under this contract, whether furnished by the Government to the Contractor or acquired by the Contractor with Government funding, shall be delivered/transmitted to the COR/federal task lead (Task Owner) upon completion of the applicable task or per instructions from the CO.

P. CONTRACTOR FURNISHED PROPERTY

The Contractor shall furnish all personnel, services, and supervision to perform the requirements of this contract and associated task orders. Except where required to be on-site at a USGS facility for performance under this contract, the Contractor would be expected to have its own facilities and equipment and support its own operations in regard to the typical product and services, technical, administrative, financial, and business functions of a going concern. The Contractor shall provide the appropriate telecommunication connectivity, as required, necessary to perform on this contract from its own facilities.

Q. DELIVERABLES

Deliverables for each task order may include, but are not limited to: status reports, presentations, analyses, project plans, delivered applications, documentation, and other work products. Specific deliverables, schedules, and documentation will be identified in specific task orders issued under this contract.

The Contracting Officer's Representative (COR) or Task Order Manager (TOM) will inspect all services and products delivered to the Government under this contract to determine that (1) the material, services, and products are complete and (2) that the documentation is adequate. If any of the above are deemed unacceptable, the COR will provide information detailing the shortcomings. The Contractor will be given two weeks from the date of the COR's memorandum to correct all shortcomings. Corrections shall bear no cost to the Government. All software developed under this contract will become the property of the U.S. Government. Unless otherwise so identified by the USGS, the Contractor understands that all software developed, improved, or in any worked on by the Contractor will be made available as open source to the user community. Appropriately identified non-open-source components will be made available in the USGS GitLab repository identified in the relevant task order(s).

The Contractor shall document work through regular emails to the COR and TOM(s) and brief quarterly reports. These reports shall discuss work addressed, progress made, problems encountered, and work remaining. The required work will be updated, and specific deadlines restated by the COR, as necessary. All software shall be documented in the appropriate repositories and websites. Invoices for services shall document the hours spent on each task or the number of sprints completed. Meetings via phone, Teams, Zoom, or other mechanism will be scheduled on an ad hoc basis in order to convey information when email is not appropriate or practical. The COR and Contractor will together establish reasonable estimated dates for completion of tasks or sprints. In any case, the Contractor

shall show reasonable and steady progress as describe in the written quarterly reports. The COR will document instances of unacceptable work or unreasonably slow progress, which may, at the option of the Government, be grounds for contract cancellation.

R. PHYSICAL SECURITY

The Contractor shall be responsible for safeguarding all Government property for Contractor use. At the close of each work period, Government facilities, equipment, and materials shall be secured.

S. INFORMATION TECHNOLOGY SECURITY REQUIREMENT SUMMARY

S.1 Background Investigation. Contractor employees who will have access to Federal information technology (IMT) systems are subject to background investigations by the Federal Office of Personnel Management. Procedures for investigations and obtaining identity credentials are described in local clause. **"Security Requirements: Facility Access and Information Technology"**. The level of investigation required will be the same as would be required for Federal employees holding positions involving similar duties, which is moderate or low risk, depending on the duties.

S.2 Non-Disclosure Agreement. Prior to receiving access to USGS computers, Contractor employees shall be required to sign non-disclosure or other system security agreements, depending on the systems to be used and level of access granted. The required non-disclosure agreement will be similar to the attached but may be customized, as needed, to reflect the data involved. Restrictions on use, duplication, and disclosure of sensitive or proprietary data are covered in clause GS 1406.

S.3 Training. Contractor employees shall complete USGS defined Federal Information Systems Security Awareness computer security training before being granted system access and must renew the training annually. Failure to complete training within the required timeframe may result in loss of system access for that user and possible removal from contract. Contract employees with significant IT security responsibilities shall also complete specialized role-based training. Contract employees shall complete any other USGS or DOI defined training that is required by policy. All new employees are required to sign the Rules of Behavior (RoB) training within 14 days of coming to work to support USGS.

S.4 Personnel Changes. Before starting to work, the Contractor will provide a listing to the COR and/or the federal TOM identifying Contractor and Subcontractor employees requiring access to USGS systems for performance of work hereunder and will assign each person a

unique user ID conforming to USGS policy in Survey Manual Chapter 600.2.1. The Contractor shall immediately advise the COR and TOM when any of their personnel no longer require USGS computer access so that those IDs and access privileges can be cancelled. The COR and TOM must be notified in advance of any potentially unfriendly termination of an employee or Subcontractor.

S.5 Contractor Location. No portion of the services to performed hereunder may be performed outside the United States.

S.6 Applicable Standards. Contractors shall follow the DOI System Development Life Cycle (SDLC), NIST SP 800-64, and the DOI SDLC Security Integration Guide. NIST SP 800-64 is available at http://csrc.nist.gov/publications/nistpubs/index.html. DOI SDLC and DOI SDLC Security Integration Guide will be provided by the Contracting Officer, upon request.

S.7 Asset Valuation. Asset valuation on USGS systems to which the Contractor may have access under this contract will be conducted by the Government or another of its contractors.

S.8 Property Rights. The Government shall be granted unlimited rights in software or data produced hereunder as described in FAR clause 52.227-17, Rights in Data-Special Works, incorporated by reference herein.

S.9 Independent Verification and Validation (IV & V). Software will be independently verified and validated by the Government or another selected contractor prior to being moved into production.

S.10 Assessment and Authorization (A&A). The Government is responsible for the A&A of IT Systems supported by this contract. Contract services may be required to develop or maintain system documentation to include hardware and software inventories, diagrams and configurations, data dictionaries, procedures (for installation, disaster recovery, configuration management, and standard operating procedures) and user guides.

S.11 Internet Logon Banner. Web based applications developed or maintained under this contract must contain the USGS approved logon banner. See http://internal.usgs.gov/gio/security/doi_2001-005_banner.pdf.

S.12 Incident Reporting. Contractor employees must report any computer security incidents (viruses, intrusion attempts, system compromises, offensive e-mail, etc.) which may affect Government data or systems in accordance with the DOI Computer Incident Response Guide. Report computer security incidents to the USGS help desk and the Computer Security Incident Response Team (CSIRT).

S.13 Quality Control (Malicious Code). All software and hardware shall be free of malicious code.

S.14 Self-Assessment. Self-assessment on USGS systems to which the Contractor may have access under this contract will be conducted by the Government or another of its contractors.

S.15 Vulnerability Analysis. Vulnerability Analysis on USGS systems to which the Contractor may have access under this contract will be the Government or another of its contractors.

S.16 Logon Banner. Applications developed or maintained under this contract must contain a USGS-approved logon warning advising users of rules, restrictions, and privacy expectations for that application. The text of such warning will be provided by the COR.

S.17 Security Controls. The Contractor shall ensure compliance with the security control requirements of the current version of NIST SP 800-53 and FIPS 200 appropriate to the sensitivity and criticality of the application/system, assigned by the Government based on FIPS 199. DOI and/or USGS common security configurations in addition to those recommended by NIST will be used where appropriate. NIST common security configurations are available from the NIST website at http://checklists.nist.gov NIST Special Publications are available on the Internet at http://csrc.nist.gov/publications/PubsSPs.html. FIPS documents are available on the Internet at http://csrc.nist.gov/publications/PubsFIPS.html. Any applicable DOI or USGS documents will be provided by the Contracting Officer, upon request.

S.18 Contingency Plan. The Government is responsible for Contingency Planning. Contract services may include responsibility for execution of a portion of a USGS-developed system contingency plan.

T. SECTION 508 COMPLIANCE

The resources acquired in this investment must meet all applicable standards established by the Access Board in 36 CFR Part 1194, including technical, functional performance, information, documentation, and support standards. The products, services, information and data that are provided to the Government or the public as a result of this acquisition shall afford individuals with disabilities access comparable to that afforded to individuals without disabilities.

Standards applicable to this acquisition include:

_X_ Software Applications and Operating Systems 1194.21

_X_ Web-based Intranet and Internet Information and Applications 1194.22

___ Telecommunications Products 1194.23

___ Video or Multimedia Products 1194.24

___ Self-Contained, Closed Products 1194.25

___ Desktop and Portable Computers 1194.26

___ Functional performance criteria 1194.31

_X_ Information, Documentation, and Support 1194.41

The full text of the above reference standards can be found at:
http://www.section508.gov/final_text.html.