Exhibit A
Statement of Work for Langley Research Center (LaRC) Geospatial Support Services (GSS)

1. GENERAL:

The Contractor shall provide all necessary geospatial products and services to the required level of detail and accuracy to enable and equip decision makers at both the Center and Agency organizational levels. Additionally, the Contractor shall provide specific geospatial products and support (as outlined in tasks) to other federal, State, and local Government agencies and other partners as either a one-time or reoccurring deliverable.

2. BACKGROUND:

The real property portfolio at NASA LaRC consists of approximately 800 acres, 169 buildings with approximately 3,000,000 sq. feet of interior space, and a current infrastructure replacement value of approximately $3.6B. In addition, LaRC also has several facilities located on the Air Force property adjacent to the research center.

Geospatial Support Services at NASA Langley is comprised of a spatial and tabular information management system that is built around the Environmental Systems Research Institute's (ESRI) Spatial Database Engine (SDE) on top of an Oracle relational database. NASA LaRC GSS currently involves heavy use of python and ESRI's ArcPY module for schema changes and data manipulation.

The GSS enterprise network data includes, but is not limited to, records such as aerial photographs, topographic maps, survey data, descriptions and engineering drawings of buildings and facilities, utility plats, geological data, climatic records, facility attribute data, financial data, as well as personnel and equipment locator records.

The location of objects such as buildings - or even individual offices - is given with high accuracy in coordinates derived from the satellite-based Global Positioning System (GPS), with LaRC's survey grade implementation routinely capable of centimeter and sub-centimeter precision and accuracy.

Other measurement technologies such as Optical Total Station (OTS), digital level, and laser scanning similarly contribute to completeness and accuracy of data through efforts such as in-field data collection or Survey and through related efforts such as Dig Permitting to ensure human safety and to prevent interruption of services to LaRC and Langley Air Force Base (LAFB) during new construction and maintenance/repair efforts to ensure continuity of operations. Attributes of features ranging from buildings to rooms to utility systems to specific pieces of equipment are available for query.

GSS Services include standard and emergency dig permitting, marking of existing facility and utility features, collection of data for newly installed features, update of spatial data, and measurement and alignment support.

Similarly, recently embraced technologies such as Building Information Modeling (BIM) are aggressively pursued to not only improve design and construction process but also provide

valuable detailed information to support operations and maintenance for the life of the structure. GSS at LaRC strives to integrate functions such as Master Plan, Real Property, Space Utilization, Facility Maintenance and Operations to increase accuracy and sustainability of data.
As part of the initiative to embrace BIM, NASA LaRC has enabled an add-on to the Computerized Maintenance Management System (CMMS) software. Currently the CMMS is IBM® Maximo® version 7.5 and just recently has been upgraded with a Construction Operations Building Information Exchange (COBie) extension.

The COBie extension of Maximo will enable direct data updates to Maximo® from a BIM. In the future when a BIM is delivered to NASA LaRC as part of a construction project, the COBie extension will allow for direct import to Maximo® the following: project data at the point of origin, equipment lists, product data sheets, warranties, spare parts lists, and preventive maintenance schedules. This information is essential to support operations, maintenance and asset management once the built asset is in service.

To enable viewing and managing the BIM inventory, IMAGINiT Clarity® software has been installed within the GSS enterprise information network to provide access to the BIM inventory. Interoperability between the various databases is pursued as much as is practical based on capabilities currently available with the technologies. Web interfaces are heavily pursued to extend benefits of these databases. Web browser interfaces allow interactive query through web pages to extract up-to-date maps, plans, or statistics restricted to selected features or to produce reports relating selected data.

Migration of web interface tools to the latest technologies available in both spatial and relational database technologies is a paramount concern. Examples are: maps depicting the effects of flooding correlated to tidal stages; maps and reports detailing utility systems; maps and reports in support of master planning (e.g. land use, security, emergency evacuation, traffic flow, parking, landscaping and environmental monitoring); and reports on space utilization (e.g., office occupancy densities for both contract and civil service personnel, and associated full cost accounting for facilities). Currently GSS at NASA LaRC uses the Jira® Task Manager software product to track requests and manage task work flows. The process to use this software in managing GSS tasks is referred to as the GSS Task Manager.

GSS support services are also provided to support mission-related programs and projects, including but not limited to, scanning of wind tunnels, models, and other scientific research equipment. Additionally, NASA LaRC enters into Memorandums of Agreement (MOA) with other national and local GSS partners. Support is currently being provided to the NASA JSC, Langley Air Force Base, the US Navy, the Fort Monroe Authority, and the City of Poquoson. Any new work will be provided under separate tasks on an as-needed basis.

3. <u>OBJECTIVE:</u>

The Contractor shall provide geospatial products and services to facilitate the maintenance, operation and enhancement of the LaRC GSS data and decision support enabled environment. This expertise will facilitate accurate and effective data utilized for managing: property and

boundaries, geodetic control, buildings, structures and utilities, environmental, safety and first responders, and facility construction, maintenance, operations, and demolition, and survey and measurement of: wind tunnels, models and other scientific equipment to support mission related programs and projects.

The proficient development, use and maintenance of spatial data and tools is imperative in providing decision makers at both NASA Langley, NASA Headquarters, and other agencies the ability to determine short and long range objectives and their most optimum solution.

4. SCOPE:

The Contractor shall operate, maintain, and update the current LARC GSS and associated data and web tool suite at NASA LaRC and also provide recurring and one-time specific geospatial product and service deliverables. The Contractor shall provide ongoing operation of existing capabilities and development, support, and analysis for enterprise class Geospatial solutions and deliverables. The Contractor shall perform all tasks in compliance with Langley Research Center Quality Management Procedures.

The Contractor shall utilize existing Government furnished software, hardware and other equipment provided while optimally staffing and locating their personnel. See Exhibit D for Installation Accountable Government Property (IAGP). The Government will also provide all IT System Administration and IT System Security in addition to any licenses utilized for this effort.

The Contractor shall utilize the existing GSS Task Manager for managing work ordered by NASA for both internal (NASA) work and external (NASA ordered work for other Governmental organizations or contractors) that utilize GSS products and services.

The Contractor shall identify, develop, test, and implement the most efficient application of geospatial tools and technology products and services. Methods, products and services developed and provided may originate from, but are not limited to, 1) commercial off-the-shelf (COTS) products, 2) a COTS product that requires configuration or customization and 3) a unique or customized product, or 4) a hybrid composed of COTS and customized products.

The Contractor shall evaluate the custom enterprise data model, then research and propose options to optimize the model's performance by shifting to an industry standard model such as but not limited to a city, county or other local government's model, utility provider model, building management model or a hybrid structure.

The Contractor shall participate in industry related conferences, maintaining relevant professional certifications, and remaining current in all practices, processes, codes, standards and specifications to support development of Next Generation GSS System.

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5. DESCRIPTION OF SERVICES:

5.1. Staffing:

Due to the rapidly evolving methods of spatial data management and decision support capability at LaRC, the Contractor shall locate no less than 80% of the WYE personnel on site, including a manager.

Any personnel not on-site shall be available for telecon and web meeting support within a 30-minute notice to interact with Center subject matter experts to provide supporting data, and address revisions or new requirements associated with the Center's infrastructure. The Government will provide at least 15 work stations continuously on site for Contractor personnel. Additional work stations and resources will be provided by the government if multiple task orders necessitate additional resources.

5.2. Technology:

The Contractor shall provide support for and utilize all facets of the Center's geospatial capabilities including, but not limited to: 1) GSS, 2) internet-based mapping solutions, 3) Geodatabase and Geocoding support, 4) Relational Database Management Systems (RDBMS), 5) BIM, 6) Survey and Measurement technologies, 7) Computer Aided Design and Drafting, and 8) Laser Scanning, Imaging, and Modeling.

5.3. Configuration Control:

For the Center and others, the Contractor shall develop, implement, and sustain configuration control for an enterprise data model, spatial and tabular data, software, and field measurement hardware.

5.4. Databases:

5.4.1. The Contractor shall maintain, operate and expand existing relational databases, geospatial databases and other databases that compose the GSS enterprise network. The GSS enterprise network also contains links to databases which are not maintained or managed by GSS, but are integral to the GSS products derived from these links such as, but not limited to the NASA LaRC Personnel Locator.

5.4.2. These databases and links are integrated with web interfaces which are continually expanded to provide more access to these databases enabling and improving data quality of maps, plans, or statistics restricted to selected features or to produce reports relating to selected data.

5.4.3. Database Management: The Government will enable and ensure continuous remote Database access as required for Database Management. The Contractor shall provide qualified personnel to accomplish database management. Qualified personnel is defined as a person with a certification as an Oracle Database Administrator. The Contractor shall accomplish routine database management including, but not limited to:

5.4.3.1. Proactively manage and performance tune the Oracle, ESRI, ArcSDE and customized data accesses to provide optimum performance enabling quick response times and preventing poor performance issues.

5.4.3.2. Model, design, and implement physical databases for geodatabase (spatial), relational, data warehousing, and business intelligence applications.

5.4.3.3. Manage the configuration, documentation, and change migration of the GSS databases, and associated schemas.

5.4.3.4. Troubleshoot and resolve hindrances to database performance such as data inconsistencies, application bugs, and similar issues. Resolve errors from batch jobs or process revisions.

5.4.3.5. Provide technical support in the utilization and maintenance of existing web tools accessing GSS databases and develop new web tools and maps for both GSS at LaRC and GSS partners.

5.4.3.6. Perform routine daily/weekly system evaluations such as ensuring that backup, recovery, and security concerns are being addressed. Evaluate and verify system capacity and configuration and notify the Government of any changes that should be addressed by other support service Contractors. Evaluate and recommend new products to extend GSS capabilities and upgrade or replace products that are approaching obsolesce or no longer supported (e.g. Oracle Reports).

5.4.3.7. Deliver reoccurring and one-time Headquarters reporting requirements for facility utilization, utility consumption, and operations/maintenance costs.

5.4.3.8. The Contractor shall routinely evaluate databases for efficiency, obsolescence, enhancements and associated applications, including, but not limited to, Facility and Utility database, Real Property and Space Utilization databases, and building interior data.

5.4.3.9. The Contractor shall schedule, configure, and test minor and major upgrades, and quarterly patches to the most recent version including, but not limited to, the following: all application software, the Oracle Database Server, Oracle Fusion Middleware WebLogic, Oracle HTTP Server, Oracle Reports, Oracle Application Express, Oracle Business Intelligence Publisher, and all

other supporting software. Current status of software version shall be managed by a configuration control process.

5.4.4. **BIM Systems and BIM Data**:

5.4.4.1. The Contractor shall review, manage, and store all new and updated BIM information for completeness and accuracy based on the stage of the project. Model updates are generated for all new building construction as well as modifications (remodeling) or upgrades (new building systems).

5.4.4.2. Export facility data from GSS, digitize as-built drawings, and incorporate and validate against Scan-to-BIM and data from other measurement technologies such as GPS and integrated survey of the facility.

5.4.4.3. When BIM data is provided with a COBie export extension file, the Contractor shall retain configuration for the model. COBie is the format standard which is designed to enhance transfer of information between BIM and Maximo® databases. Other methods of data transfer shall be utilized if a BIM does not have the COBie data extension.

5.4.4.4. Maintain BIM systems populated with data fields (i.e.: manufacturer's model and serial number along with other specifications). The Contractor shall take receipt of BIM systems with updates from facility upgrades, remodels and new construction projects. The Contractor shall then validate the model through the configuration control process and then export relevant data utilizing the COBie extension of IBM Maximo®.

5.4.4.5. Develop and support a strategic plan for use of BIM at LaRC which includes, but is not limited to:

- 5.4.4.5.1. BIM standards, templates and support tools
- 5.4.4.5.2. BIM procedures and support guides for BIM Viewers, Users, and Power Users
- 5.4.4.5.3. BIM Training objectives, guidelines, and documentation
- 5.4.4.5.4. NASA's BIM requirements, specifications, and standards
- 5.4.4.5.5. Training regarding BIM and COBie capabilities, possibilities, and considerations
- 5.4.4.5.6. Discrete Project Contract Templates for BIM and COBie requirements and deliverables
- 5.4.4.5.7. Template for BIM and COBie Project Execution Plan and Level of Detail requirements
- 5.4.4.5.8. Develop and implement a process to accept new files, revisions, and updates which meet configuration control standards
- 5.4.4.5.9. Manage the BIM inventory using IMAGINiT® Clarity or similar products to provide access to BIM information.

5.4.4.5.10. Enhance data exchange capability between BIM, GSS, and Civil 3D.

5.5. Spatial Data:

5.5.1. The Contractor shall provide customer support, consultation, and training for all GSS portal web-based products associated with Spatial Data Maintenance and provide monthly benchmarks of web services to LaRC customers. Additionally, the Contractor shall support the GSS Task Manager or equivalent in tracking GSS work efforts as well as Concurrent Version System (CVS) to manage versions of tools.

5.5.2. The Contractor shall maintain and increase the performance of GSS links and interfaces that provide spatial references and systems supporting including, but not limited to: 1) CMMS, 2) Environmental, 3) Safety, 4) Security, 5) EMCS, 6) Condition Based Maintenance, 7) Personnel Locator, and other similar functions.

5.5.3. The Contractor shall export geometry and prepare data to support functions including, but not limited to: 1) base map. 2) Property, utilities, and facilities, 3) Personnel Locator, and 4) Space Utilization. This includes support through all phases of project from initial through subsequent changes.

5.5.4. The Contractor shall maintain and enhance the complete LaRC GSS operational environment by collecting, editing, analyzing, maintaining, and disseminating spatial data. The Contractor shall provide for continuing maintenance and guarding against obsolescence of software products and their support to provide the display, maintenance, and publication of: spatial and tabular data, Planning Data, used for but not limited to: the Center Master Plan, the Master Facility Listing, other strategic planning documents, and GSS related products.

5.5.5. The Contractor shall maintain the data quality and seamless functionality of spatial and facility attribute data within the GSS by utilizing the ArcSDE component of ESRI's ArcGIS Server Enterprise product.

5.5.6. The Contractor shall perform the extract, transform, and load data processing functions to migrate data into GSS, integrate data between GSS and other systems (e.g., NASA IdMAX/ICAM, Maximo, BIM, EMS, safety, security), and populate data warehouses including, but not limited to, the Facilities and Related Services Expense Tracking System.

5.5.7. The Contractor shall maintain spatial data layers providing complete and continuous functionality of the GSS web based portal environment. Spatial data layers shall be managed through a configuration control process.

5.5.8. **Spatial Data Support for Buildings and Planning**:

5.5.8.1. The Contractor shall review the current use of LaRC's facilities and utilities in the context of long term planning and respond to requests for scenario based analysis using the GSS enterprise information Network.

5.5.8.2. The Contractor shall provide products generated from spatial data to include, but are not limited to: 1) maps depicting the effects of flooding correlated to tidal stages; 2) maps and reports detailing utility systems; 3) maps and reports in support of master planning (e.g. land use, security, emergency evacuation, traffic flow, parking, landscaping and environmental monitoring), 4) reports on space utilization (e.g., office occupancy densities for both contract and civil service personnel, and associated full cost accounting for facilities), and 5) optimized location and placement of Multi-Functional Devices. Automated space allocation optimization is an area where spatial data technologies are being applied to increase overall efficiency and effectiveness.

5.5.8.3. The Contractor shall migrate data updates from field data sources, to the ESRI SDE, the Arc GSS Server, and the Portal web visualization tools to provide the most current version of GSS tools consisting of mapping products and derived PDF files.

5.5.8.4. The Contractor shall provide support for the maintenance and obsolescence avoidance of GSS tools including, but not limited to, the LaRC Flood Prediction Tool, the LaRC Building and Room Locator, the LaRC Equipment Locator, Utility Viewer, and the LaRC Floor Plan Viewer.

5.5.8.5. These tools shall be modified and or rewritten for deployment under the SDE GSS databases, ArcGIS Server, and Portal software. This will include use of applications such as, but not limited to, ESRI City Engine, to develop visualizations of Center resources and changes.

5.5.8.6. The Contractor shall configure Government Accountable Property mobile devices (refer to Exhibit D Equipment List) for in-field data collection and display and research new platforms to improve the overall mobile data gathering process.

5.5.9. Requirements for Spatial Data originating from other than LaRC GSS: The contractor, at times, shall receive data from others (e.g., General Services Administration, Army Corp of Engineers, or LaRC contractors), that support new

designs, design changes and modifications, and as-constructed, that may be in the following formats:

5.5.9.1. File Geodatabase, Shape File, Revit, or AutoCAD.dwg files with all points and vectors properly geo-referenced to the datums referenced for the GSS and including the data provider's metadata.

5.5.9.2. Data shall contain a job information file listing, at a minimum, the Contractor's company name, address and phone number, project supervisors' and field leaders' names and information, contact number and/or job name, NASA COR name and contact information, completion date, check date, datum and projection of all coordinate data, and a data dictionary or expanded feature code library.

5.5.9.3. The filename shall indicate the job name or contract number, (e.g., jobname.txt). In the case of general purpose surveys by outside or subcontractors, check shots on at least two monuments in the control network shall be performed as a matter of quality assurance prior to performing any production work. Check shot deltas, showing monument name and H & V deltas from listed values, shall also be included in this file.

5.5.9.4. All spatial and tabular data applications shall be compatible with current ESRI, Oracle, or Autodesk product suite and shall be maintained using the CVS and/or similar products such as Git.

5.5.9.5. Data received not conforming to these requirements shall be forwarded to the COR for resolution.

5.6. GSS Survey:

5.6.1. The Contractor shall apply the most appropriate technology in all survey measurement recordings. Use of the spatial position of objects such as buildings or individual offices or specific components or utility features are given with high accuracy in coordinates derived from GPS technology.

5.6.2. Other measurement technologies such as OTS, Digital level, and laser scanning similarly contribute to completeness and accuracy of data and shall be utilized as either establishing measurement data or verifying existing data.

5.6.3. The Contractor shall attend a weekly meeting (averaging 1-2 hours) with Air Force personnel at LAFB to discuss surveying requirements and coordination of work in the East Area of LaRC that may impact LaRC infrastructure.

5.6.4. Requirement for State Licensed Surveyor: While there are no requirements or deliverables which require the services of a State licensed surveyor, if a requirement to provide a professional certification of data, or involvement of specialists to support unique measurement requirements exists, it will be addressed in a specific Task Order or funded as Other Direct Costs (ODC).

5.6.5. GSS Survey of Construction, Research and Science Projects:

5.6.5.1. Typical efforts for Construction, Research, and Science project support includes, but are not limited to, 1) locating features, 2) benchmarks, 3) pins, 4) utilities stakeout, 5) layout of foundations, 6) walls, 7) walkways, 8) parking areas, 9) utility ducts, 10) utility features, 11) archaeological features, 12) planting areas, 13) trees, 14) roadways, 15) test ranges, or 16) any other point, line, or area designated by the GSS LaRC or GSS partner.

5.6.5.2. Effort also includes measurement support for research apparatus, support systems, machinery, or other items requiring precise placement. Feature geometry, coordinates, feature codes, and other related data from electronic survey/stakeout or digitization shall be stored on the government server and accessible to GSS for analysis.

5.6.5.3. Effort may require the professional certification of data by a state licensed surveyor or the involvement of other measurement specialists to support unique measurement requirements. These costs shall be addressed in a specific Task Order or funded as Other Direct Costs (ODC).

5.7. GSS Measurement:

5.7.1. The Contractor shall utilize specific measurement standards as identified in task orders to maintain a specific geodetic control network. The coordinates for a control network are physically depicted by a set of monument control points (usually brass disks set in concrete) at various strategic locations.

5.7.2. The Contractor shall provide qualified personnel in managing the NASA LaRC Geodetic Measuring System. Qualified personnel is defined as at least one person with an “Online Positioning User Service Project Manager” certification from the National Oceanic and Atmospheric Administration’s National Geodetic Survey (NGS).

5.7.3. The Contractor shall provide necessary maintenance to ensure the functionality of the geodetic measurement control network at LaRC which includes, but is not limited to, 1) base station operation and repeater setup, 2) field observation and recording, 3) integrating external networks NGS point data to refine the network

and, 4) ensure equipment readiness, personnel training and reports relating to equipment status.

5.7.4. The Contractor shall provide survey and measurement services to include, but not be limited to: 1) marking and recording of existing facility and utility features, 2) collection of data for newly installed or renovated features, 3) update of LaRC or GSS partner's spatial data in the GSS environment, and 4) measurement for modeling of LaRC or GSS partner's facilities and machinery alignment.

5.7.5. The contractor shall provide support for GPS and related activities, including use of the OTS, laser scanning systems, and systems to collect and use spatial data in the field.

5.8.GSS Mapping:
The Contractor shall provide, maintain, and update standard sets of commonly used maps including, but not limited to, LaRC map of Center facilities for use at badge and pass office , snow removal maps, water valve isolation, floor plan, spill plan; and generate map books for large areas. A custom use or unique map shall be developed based on existing available data unless otherwise specified in a task order.

5.9. Visualization:

5.9.1. The Contractor shall provide generation of visualizations such as static and simulated fly-through, electronic models, tabletop models, view sheds, and perspective renderings, and develop views to meet evolving needs for the electronic model and support web enabling for various uses including, but not limited to, maintenance.

5.9.2. The contractor shall supply GSS related products, including the following but not limited to:

- 5.9.2.1. Acquire and store imagery, thermal imagery and Light Detection and Ranging (LIDAR) data
- 5.9.2.2. Use LIDAR data to develop composite images
- 5.9.2.3. Develop and maintain all sources of imagery for current and future uses
- 5.9.2.4. Laser scans and imagery collection (including spherical photos)
- 5.9.2.5. Data acquired through use of Commercial off the Shelf (COTS) Unmanned Aircraft System (UAS). The Contractor shall be certified when operating a COTS UAS. Certified is defined as a certification in ground operations by the COTS UAS manufacturer.

5.10. Analytics:

5.10.1. The Contractor shall utilize and enhance geospatial analytics services, methods, and tools including, but not limited to: 1) geospatial dashboards/mash-ups, 2) requirements gathering and analysis, 3) data clean-up and validation, 4) facilities and environmental management mapping and analysis, 5) data mining and statistical analysis of data, and 6) applying optimization algorithms to databases.

5.10.2. The Contractor shall provide the data formatted to routine and customized queries and reports which supports decision makers in areas including, but not limited to, real property: 1) scenario planning, 2) space use and optimization plans, 3) sequencing plans for capital projects, 4) capacity ratios and recommendations, 5) Gap Analysis for lowering Total Cost of Ownership, 7) Portfolio Analysis such as Master Facilities List, and 8) other in-depth analyses of existing facilities: location, capability, utilization, and condition surveys.

5.11. Software applications:

5.11.1. The Contractor shall utilize and enhance the application of software in their performance of this statement of work and recommend software revision updates or different applications. The Contractor will also identify opportunities to consolidate or discontinue the use of software applications. Software updates and revisions shall be managed by a configuration control process.

5.11.2. The Contractor shall use the LaRC GSS software applications (both desktop and appropriate Web-enabled tools) to maintain functionality interfacing the various spatial and other databases included in the GSS enterprise information network. This data includes, but is not limited to; aerial orthophotos, contours, transportation, green spaces, environmental features (wells, runoff areas), buildings, (including building interior details and layout, roof compositions, floor coverings, and similar attributes), and utilities.

5.12. Next-Generation GSS Systems:

The Contractor shall remain current on industry developments and evaluate the GSS Enterprise Network for potential hardware, software, and peripheral equipment changes or upgrades that should be investigated or pursued for efficiency and effectiveness including, but not limited to:

5.12.1. Develop and implement the capability to generate schematic diagrams from spatial and tabular utility data.

5.12.2. Develop and implement a GSS system that will allow intelligent network routing including flow of utilities and vehicle/pedestrian transportation network.

5.12.3. Develop and implement an interface to Center data services which utilizes GeoEvent processor to address display of data available in various near real time database tools such as OSI Soft PI Integrator to support dashboard display in Portal.

5.12.4. Evaluate the methods to migrate from the current custom enterprise data model to a contemporary industry data model. Review and evaluate data models such as local Government, Building Interior Spatial Data Model, and industry leading utility data models for baseline proposals.

5.12.5. Design, implement, and maintain web applications to manage facility attribute data, integrate GSS maps, and provide business intelligence. Design, implement, and maintain web applications to manage facility attribute data. Identify and define requirements for, but not limited to, the acquisition of: 1) GSS or IT related hardware and or software, 2) GSS related equipment or data, 3) additional labor resources, and 4) any training or travel not previously proposed or reviewed.