

**U.S. GEOLOGICAL SURVEY/EROS CENTER
TECHNICAL REQUIREMENTS DOCUMENT
for the
TECHNICAL SUPPORT SERVICES CONTRACT SOLICITATION**

TRD NUMBER

022

PERFORMANCE PERIOD

Contract Base Year: April 1, 2010 thru March 31, 2011

PROJECT NAME

Remote Sensing Technologies

1.0 Scope

This Technical Requirements Document (TRD) outlines the Technical Services Support Contract (TSSC) support needed by the U.S. Geological Survey's (USGS) Earth Resources Observation and Science (EROS) Center, Remote Sensing Technologies (RST) Project during Contract Year 1, April 1, 2010 through March 31, 2011.

The TSSC coordinates and performs these tasks to meet the strategies, goals and directions of the USGS RST Project Manager. The major tasks for RST are: 1) Instrumentation and Analysis; 2) Aerial Camera Characterization and Calibration; 3) System Characterization/Calibration and Product Verification/Validation, including Joint Agency Commercial Imagery Evaluation (JACIE) team support; 4) Aerial Mapping Digital Sensor Characterization and Calibration; 5) Commercial Data Requirements & Acquisition; and 6) Orthoimagery Development Acquisition – Camera Calibration Research. These major tasks are highly dependent on one another and will require TSSC project management support at the task level, as well as, for the project as a whole.

Technical Agreement

Remotely sensed data is of great value to the USGS and other agencies involved in the management, study, and monitoring of the Earth's surface. The usability and reliability of these data for users and decision makers depends on the accuracy with which these data accurately represent the surface of the Earth and the processes underway on it. The USGS, as a critical provider as well as user of remotely sensed data, products and services places a critical reliance on the accuracy of these data and understanding the capabilities and limitations of the data due to the technologies used to generate these data. Other agencies as well as the broad user community in the US and around the world rely on the USGS to provide assessment of these data. The value of remote sensing data is assessed according to its accuracy and ability to assess change required to address societal needs. The RST project specializes in understanding sensor and system technology to ensure data is traceable to standards and thus to historical science data which can be used to create relevant science information products. It is imperative that the USGS maintain and improve its ability to perform this national service. Governmental and scientific users face a wide range of choices when selecting data sources for enhancing their understanding of the land relative to their missions. Chartered with organizing and simplifying the mechanisms for selecting and receiving data for use in emergency situations as well as planned scientific research or government business, the USGS stays aware of data sources and negotiates better purchasing agreements with less restrictive licenses. USGS can also serve a broader range of civil customers and facilitate the reuse of purchased data assets by the USGS, the National Geospatial-Intelligence Agency (NGA), the Department of Agriculture, and other large federal distributors of commercially acquired licensed data.

The USGS needs access to a broad range of remote sensing technologies, expertise on airborne and satellite platforms to fulfill its mapping and science mission requirements, as well as knowledge in photogrammetry and digital aerial camera and their image processing systems. It is critical that these systems and sources be adequately characterized and the utility of the data sets be fully understood before the data can be reliably used for earth resources observation and science. It is also in the interest of the USGS to be fully engaged in the implementation of the National Remote Sensing Policy on behalf of the Nation's Federal Civil Agency community.

USGS EROS has broad goals to support through the guidance provided by the Land Remote Sensing (LRS) Program and the National Geospatial Program (NGP). The LRS guidance document provides requirements and associated tasks and describes a wide variety of sensors and data from government, international and commercial sources for both airborne and space-borne systems. While the USGS has historically been involved in many of these tasks, the RST project was formed to strengthen USGS capabilities and to promote increased cooperation and coordination within the Bureau and among other Federal Agencies. RST project was also established to provide focused science and technology development goals to these disparate tasks and desires to leverage the personnel and physical resources involved in these tasks to form a stronger USGS capability in characterization/calibration and science application of remotely sensed data.

The RST project, as led from the USGS Earth Resource Observation and Science (EROS) Center, coordinates with specialists at various USGS locations as well as partners throughout the federal and local government, industry, and academia. The Remote Sensing Technologies (RST) Project will maintain and build upon the strengths, capabilities, and relevance of the USGS in understanding, assessing, and supporting the various technologies necessary to remotely sense the earth's surface and environment. These technologies range from the detection of photons at the sensor level to the operation of these sensors and algorithms used to ensure that remote sensing products accurately represent the original sensed surface or environment, and the technologies and methods for ascertaining the accuracy of these processes.

The RST project will provide services to the nation in calibrating aerial cameras; provide calibration and characterization of remote sensing system, assessing the quality of aerial and satellite data and systems, and developing new methods and procedures for ensuring that the Nation's remotely sensed data are of the highest quality. The two most significant project efforts currently underway in the RST Project are the leadership and coordination of federal agency assessments of commercial and international remote sensing data and systems, and an effort to develop standards including calibration and validation processes for the rapidly evolving digital aerial remote sensing industry within the United States. The topics below summarize the scope of RST Project for the second half of FY2010 and the first half of FY2011.

1.1 Instrumentation and Analysis:

The USGS has entered into agreements with several other government agencies, most notably NOAA and USDA, to jointly operate and maintain a series of instruments that monitor Earth surface conditions on EROS property and on other sites located in Kansas and Brookings, SD. These various networks each continually measure surface conditions and are key contributors to land and climate monitoring and provide support to monitoring networks to help the US, North American, and international partners better understand the earth's systems. EROS is responsible for light maintenance and the communication links to allow the data to be transferred to data central repositories. Examples of this effort include: 1) establishing and maintaining instruments and instrumentation sites in conjunction with Federal and International Partners; 2) maintaining associated software and network requirements in support of national meteorological climatic, meteorological & global positioning information; 3) support the use of data in various projects and climatic research at EROS, USGS, and within the remote sensing science community. The current sites and networks include the following as well as support for other remote sensing validation instruments:

Constantly Operating Reference Station –CORS – Provides reference quality positioning from NOAA National Geodetic Survey (NGS);

GPS Surface Observing System –GSOS - Water vapor precipitation information from GPS signals from NOAA Earth Systems Research Lab, Global Systems Division (GSD);

US Climate Reference Network –CRN - Provides reference quality meteorological data from NOAA National Environmental Satellite, Data and Information Service (NESDIS) National Climate Data Center (NCDC);

Soil Climate Analysis Network –SCAN – Provides soil temperature, moisture, salinity network from USDA NRCS;

Surface Radiation Network –Surfrad – Provides reference quality surface radiation from NOAA Global Monitoring Division (GMD);

Aerosol Robotic Network – AERONET – Provides global aerosol measurements to network at NASA GSFC, the USGS operations to Cimel instruments in conjunction with this program;

FLUXNET - a network of regional networks," coordinates regional and global analysis of observations from micrometeorological tower sites. USGS supports a NASA, and DOE Oak Ridge National Laboratory collaboration for carbon assessment using Eddy correlation flux towers. The USGS owns two carbon flux towers being used here;

Canadian Reference Climate Station (RCS)- USGS, NOAA, and Canadian Environment agreements provide for the USGS site allowing for the only US NOAA CRN and Canadian network comparison site;

USGS Seismic Station - Advanced National Seismic System (ANSS); Supports the USGS network with a site location at USGS EROS Center.

1.2 Aerial Mapping Camera Calibration (USGS Optical Science Laboratory):

The USGS Optical Science Laboratory (OSL) calibrates 65 – 90 film cameras annually that are used for aerial mapping in North America and Internationally since 1973, and is globally recognized for providing this unique and essential service. The OSL employs an operational-type photographic method using multiple collimated precision targets and special flat photographic glass plates for the determination of lens and camera calibration coefficients. Optically flat, photogrammetric, quarter-inch thick glass plates coated with light sensitive photographic emulsion are used to calibrate film-based aerial mapping cameras. The project expects the TSSC to continue this support as well as planning for glass plate procurements and or replacement technique in the future as photographic manufacturers discontinue those inventories. Hardware and software upgrades will also be required to maintain precision calibration reports at the OSL.

1.3 System Characterization:

USGS chairs the Joint Agency Commercial Imagery Evaluation (JACIE) team consisting of representatives from U.S. Department of Agriculture (USDA), National Aeronautics and Space Administration (NASA), and the National Geospatial-Intelligence Agency (NGA). The focus of JACIE is to support a national imaging program and continue to work high to medium resolution system characterization and applications assessment for satellite and aerial sensors. Recently, a strong focus has been new digital imaging systems including advanced digital camera, SAR, and LiDAR systems.

USGS is also a key member of the Landsat Data Gap Study Team (LDGST) and is leading the implementation of gap filler datasets required to minimize the disruption in the 35+ years of Landsat data archives. USGS coordinates data ingest and downlinks

at the EROS Ground Station from systems; such as the China/Brazil Environmental Satellite (CBERS) and India Space Research Organization (ISRO) ResourceSat type satellites, to demonstrate the ability to get data over the contiguous United States, and to assess and understand the quality and potential for data from satellite data providers existing and future systems. The USGS RST project works directly with many domestic and international satellite owners to access and evaluate instrument data in support of USGS and US Government science needs. On-going actions from the LDGST include follow-on radiometric data assessments, obtaining test data over designated range areas, and setting up and obtaining test data for candidate systems via joint field assessment campaigns. The project utilizes cross calibration techniques and science support to show the value of multi-mission/instrument data in support of integrated science products. The instrument data acquisition capabilities include both active and passive sensors ranging from the ultraviolet to the microwave regions of the electromagnetic spectrum. The project also continues to evaluate new sensors, systems, and technologies that support national land imaging science and provide new mission recommendations and requirements. This effort includes calibration and validation requirements for USGS programs and projects.

The USGS RST Project, as a supporting member of the Committee on Earth Observation Satellites (CEOS) and Global Earth Observation System of Systems (GEOSS) has worked with partners around the world to establish an online catalog of test sites for the on-orbit characterization and calibration of space-based optical imaging sensors. This online catalog provides easy public Web site access to vital system information for the global community.

1.4 Digital Aerial Mapping Camera Calibration:

Based on the recommendation of American Society of Photogrammetry and Remote Sensing (ASPRS) and contact with Federal, State, and Local government agencies and their contractors, many agencies at all levels of Government have common, immediate, digital imagery needs and requirements. The digital aerial imagery community at-large highly recommends USGS as the optimal agency to provide policy, guidelines, and standards for digital image data acquisition. Thus, USGS established and chairs the *Inter-agency Digital Imagery Working Group (IADIWG)* <http://calval.cr.usgs.gov/crs/iadiwg.php> in support of new standards and quality assessment methodologies for the calibration of aerial digital imaging systems. The IADIWG consists of fourteen U.S. Government agencies whose purpose is to identify common requirements and issues related to digital imagery acquisition policies, guidelines, and standards and work together toward providing optimum and efficient acquisition solutions for the community.

The USGS, with IADIWG support, drafted the USGS Quality Assurance Plan for Aerial Digital Imagery including contracting process and boilerplate specifications, manufacturer and data provider certification and quality control and quality assurance processes. The USGS Plan guides and strengthens the emerging digital aerial data industry and consumers and encourages the use of digital aerial data within the United States as well as ensuring that these new data are of acceptable quality. Ultimately, the goal is to convert these efforts into reimbursable efforts which would provide some funding support for the core USGS technology team. Until then, the USGS LRS and NGP programs continue to support these efforts into FY10 and beyond as needed.

Specifically, support includes areas such as manufacturer certification, data provider process development and range development, and contracting guidelines and QA tools.

The USGS continues to research and provide laboratory and in situ testing of new digital camera and imaging technologies. This information is reviewed across agencies and partner organization, such as IADIWG, NSGIC, ASPRS, CEOS, MAPPS, and others.

1.5 Commercial Data Requirements & Acquisition:

The Commercial Data Requirements & Acquisition Task is responsible for maintaining multiple external relationships or partnerships with USGS Headquarters, NGA, NOAA, USDA and several other civil agencies. Key objectives for this task are to maintain and execute task plans, adhere to budget marks, travel and coordinate with other Commercial Remote Sensing Space Policy (CRSSP) leaders and constituents, and oversee the task objectives. The requirements portion of this task may grow in support of the NOAA CASSNOVA project in the future.

1.6 Cross-Cutting Products & Services – Research – All Products – Applied Research:

The USGS National Geospatial Program (NGP) supports QA and Data Provider process evaluation and associated training tasks. This effort will be done in conjunction with National Geospatial Technical Operations Centers (NGTOC) employees and other Government and industry support. EROS and RST Project will continue to lead the USGS QA Plan and provide leadership and task support. The NGP portion of his effort will include planning and associated meetings, web support and QA Plan training. In conjunction with key staff from the NGTOCs and other USGS facilities, RST plans to continue development of a USGS Aerial Imagery Specification and Quality Assessment Tool (hereafter the “Tool”) to provide users and procurers across the country a resource to 1) develop clear and consistent specifications for digital aerial imagery products suitable for use in contracts, and 2) develop quality assessment processes and aids that will, in parallel with the contracting specifications, assist the user in quantitatively determining that the products received meet those specifications.

The Data Provider evaluation process and associated in-situ characterization ranges have become a high priority for the NGP and will be considered top priority in FY10 and FY11. The establishment of a reimbursable and operational process will also be defined and required from the contractor. The *in-situ* calibration analysis work will also continue into FY10 and FY11. The TSSC will also coordinate work via Technical Assistance Agreements (TAAs) between the USGS and aerial data providers and academia to provide greater testing capability to validate various methods.

2.0 Deliverables

The RST Project is a rapidly-evolving project within the USGS. While the roles and future of the project continue to be shaped, general management tasks will be required across the entire Project and will require TSSC support. The TSSC shall continue to provide technical, financial and USGS programmatic support required throughout the entire year. Delivery of the respective work cost and schedule progress reports shall be

on a monthly and quarterly basis for all project tasks including an overall RST project schedule. Weekly highlights shall also be delivered on an as needed basis. TSSC shall also support and travel to conferences and workshops related to RST project tasks including but not limited to ASPRS, ISPRS, CEOS, CALCON, and other meetings and conferences. The support shall include taking meeting minutes, making presentations, and co-authoring technical papers.

Written TSSC travel reports shall provide a summary, synopsis, recommendations, and actions/conclusions for RST and USGS for all travel performed on project funding. In addition, the TSSC shall continue to provide RST general Web software support and updates as necessary. This work shall be deliverable as described and shall also be ongoing throughout the contract year.

In general, a goal of the RST project is to add value to the USGS LRS and NGP Programs, EROS, USGS, and the Nation. One way to add and maintain that value is to grow the RST project to support and characterize the multiple, current and new technology remote sensing systems needed for the USGS to address the global earth observation (GEO) societal benefit areas (SBAs). While this role is inherently governmental the TSSC can provide valuable assistance and resources that aid in the growth of RST. Support to the following tasks is requested of TSSC to assist in this ongoing improvement and growth of the RST Project.

The six major BASIS+ Tasks and deliverables for second half of FY2010 and the first six months of FY2011 are documented in paragraphs 2.1 thru 2.6:

2.1 Instrumentation and Analysis:

The USGS has entered into agreements with several government agencies, most notably Canada's RCS, NOAA and USDA networks, to jointly operate and maintain a series of instruments that monitor Earth surface conditions on EROS property, along with sites in Kansas and Brookings, SD. These various networks each continually measure surface conditions with EROS as the group responsible for ongoing light maintenance and maintaining the communication links that allow the data to be transferred to their central data repositories.

- a. **Task:** The TSSC shall provide limited telecon and technical meeting support for Terrestrial Monitoring and National Ecological Observation requirements with respect to cal val, provide planning and support for established in situ ranges, and support the EROS camera calibration laboratory instrument needs.

Deliverable: Support described above, communicated in status reports.

Schedule: Provide reports weekly and monthly as required.

- b. **Task:** The TSSC shall provide ongoing maintenance and support for the instrumentation managed or supported by the RST Project. This includes the "EROS Instrument Farm", the Carbon Flux Tower located near Brookings, SD and other field instruments. This support shall be both routine maintenance and as-needed unscheduled support. This includes assorted lab and hand-held instruments and other RST equipment and infrastructure. This support shall include inventory tracking, organization, routine and unscheduled maintenance, recommending upgrades and documented procedure maintenance.

Deliverable: Support described above, communicated in status reports.

Schedule: Provide reports weekly and monthly as required.

- c. **Task:** The TSSC shall implement a documented plan showing the implementation for an internet web page providing weather instrument climate monitoring information to EROS public web pages. This should include a possible EROS weather station page with links to other instrument datasets.
Deliverable: Written plan describing the above.
Schedule: Provide Plan as described.

2.2 Aerial Mapping Camera Characterization and Calibration:

For over three decades, the USGS has been responsible for providing characterization and calibration services for the nation's aerial film mapping cameras. This work is performed at the USGS Optical Sciences Laboratory (OSL) at USGS Headquarters in Reston, Va. and is critical to the aerial mapping industry and must be maintained. Key updates to the laboratory have been made in the last several years and must continue as older systems and capabilities are modernized. Key issues this year include manufacture sensor type certification and data provider evaluation processes, as well as, enhancing the evolution to digital small and medium format systems. Funding for this work is generally provided through reimbursable fees charged to the owners of cameras who submit their cameras to the USGS for characterization and calibration.

- a. **Task:** The TSSC shall provide management support for the Optical Science Laboratory (OSL) in Reston and its contents, including continuing general operation of the OSL in Reston, VA. This shall include the routine maintenance, servicing, calibrations and upgrades as directed as well as characterization and calibration of aerial film cameras submitted by various camera manufacturers. The TSSC shall provide staffing for day-to-day operations and expertise in photogrammetry and sensor calibration.
Deliverable: Support described above, communicated in status reports.
Schedule: Provide monthly and weekly status reports.
- b. **Task:** The TSSC shall continue to review and recommend options for operating the OSL. Reports and briefing should be made to RST regarding operational and budgetary trade-offs regarding the OSL.
Deliverable: Written reports and slides containing results of investigations and recommendations.
Schedule: Provide the report and PowerPoint slides.
- c. **Task:** The TSSC shall prepare documentation processes and procedures to ensure proper quality control of instruments, services, and data in the calibration process. These processes shall be similar to ISO-9001 type quality documentation processes.
Deliverable: Support described above with status reports.
Schedule: Report monthly and weekly as required.
- d. **Task:** The TSSC shall continue to investigate options for supplying glass plates or potential replacement technologies and make recommendations to the USGS into potential glass plate replacements.
Deliverable: Written report containing results of investigations and recommendations.
Schedule: Provide the recommendation.

- e. **Task:** The TSSC shall continue OSL billing support through Denver Customer Services by providing Performa Invoices to customers of the OSL. These invoices provide cost estimates for calibrating aerial cameras and other services at the OSL in Reston. The monthly average is about 7 invoices - but can be as low as 3 and as high as 10 - 12. Although EROS will no longer be used for billing - the OSL will still have reimbursable income from these services.
Deliverable: Written report containing results of contacts with OSL customers.
Schedule: Reports as required.

2.3 System Characterization and Product Verification/Validation:

The USGS is one of the world's leading providers of remotely sensed data and the RST Project provides the capabilities and skills necessary to assess and understand the technical performance of various remotely sensed datasets. These capabilities can be used to assess new data, monitor ongoing data received and provide supporting expertise for remote sensing data QA and QC activities. RST system characterization group's primary responsibilities at EROS include satellite sensor characterization and calibration research to support on going radiometric and geometric projects. Current radiometric research focuses on cross-calibration between various sensors from different platforms for mission continuity, thereby providing consistent measurements of Earth's surface features. Two major thrusts in this task include JACIE support and the Land Cover Land Use Change (LCLUC) effort under ROSES Proposal grant from NASA. This task is highly visible and the contractor must provide support to make the effort successful. Continued efforts will also be required in the area of system characterizations for the USGS LDGST. USGS and TSSC managers will coordinate these activities to maximize accomplishments prioritized according to funding and available resources.

- a. **Task:** The TSSC shall support testing and assessment of satellite and instrument data ingested via the internet, direct downlink or other methods for remote sensing systems; such as, CBERS, ResourceSat, SPOT, Worldview, GeoEye, DMC, and others as required. The TSSC shall coordinate and facilitate data ingest and provide instrument evaluations and science assessment of the data. The TSSC shall provide for the geometric and radiometric analysis, and scientific usability of remotely sensed data products as directed and supported by the RST Project Manager. Since each particular dataset may have its own unique characterization needs these will be described by the USGS Project Manager when the datasets are made available for analysis.
Deliverable: The TSSC shall provide assessment reports for data ingested and analyzed. The TSSC shall provide up to four quick-look assessment reports and briefings for JACIE. Additional detailed analyses will be required as directed by the RST Project Manager.
Schedule: Status of these analyses will be provided monthly and weekly as required. Reports will be provided as required.
- b. **Task:** The TSSC shall support testing and assessment of visible and infrared sensors, IFSAR, Lidar and Hyperspectral remote sensing instrument data. The TSSC shall provide for the geometric and radiometric analysis, and scientific usability of remotely sensed data products as directed and supported by the RST Project Manager. Each particular dataset may have their own unique characterization requirements and will be described by the USGS Project Manager as those datasets become available for analysis.

Deliverable: The TSSC shall provide assessment reports for data ingested and analyzed. The TSSC shall provide quick-look assessment reports and briefings for JACIE. Additional detailed analyses will be required as directed by the RST Project Manager.

Schedule: Status of these analyses will be provided monthly and weekly as required. Reports will be provided as required.

- c. **Task:** The TSSC shall support the Joint Agency Imagery Evaluation (JACIE) 2010 Annual Workshop as well as planning and support for the 2011 and 2012 workshops including presentations, workshop analyses and follow-up activities subsequent to the 2010 workshop.

Deliverable: Follow-up reports and support for JACIE 2010; planning for JACIE Workshops in 2011 and 2012 if appropriate and to include a presentation of USGS data set analyses.

Schedule: Provide weekly and monthly reports as required during the contract period. Provide JACIE workshop posters and presentations via the USGS review process.

- d. **Task:** The TSSC shall provide a plan to ensure that data used in analyses and the reports generated from the analyses are catalogued and stored for future reference and support of the analyses generated with these data.

Deliverable: Provide a plan indicating implementation and schedule for the above task.

Schedule: Provide a plan indicating implementation and schedule for the above task .

- e. **Task:** The TSSC shall continue to support and maintain the RST project World-Wide Test Site Catalog website, including adding sites as they become available. The TSSC will interface with CEOS WGCV Cal Val Portal developers to ensure access to the test site catalog and associated data is available to the GEO community.

Deliverable: Maintain World-wide test site catalogue.

Schedule: Report monthly any activity or progress

- f. **Task:** The TSSC shall provide support to meet the requirements of the NASA ROSES LCLUC Proposal.

Deliverables: TSSC shall provide deliverables as defined in the above proposal.

Schedule: Provide deliverables in accordance with above proposal. Provide progress status in monthly and weekly reports.

- g. **Task:** The TSSC shall support CEOS WGCV and QA4EO. This will include planning and generation of supporting documentation for CEOS WGCV plenary and workshops, CEOS WGCV IVOS and related meetings.

Deliverables: Provide plans and support documents for meetings as required.

Schedule: Report progress and status weekly and monthly and provide briefings and reports.

2.4 Digital Aerial Camera System Characterization and Calibration:

In addition to the long-standing USGS responsibility for aerial film camera characterization and calibration as described above, the USGS has been charged with researching new methods for characterization and calibration for aerial mapping

cameras, especially those with new digital sensor technologies. To this end the USGS has begun several concurrent research efforts including establishing a small- and medium-format digital camera calibration lab at EROS, developing *in-situ* methods for aerial camera calibration under contacts and grants with OSU Topo-Photo and the University of Calgary, and developing methods for characterizing sensor MTF. This Task also includes development and maintenance of Calibration and Validation Test Ranges intended for use by satellite and aerial digital sensors.

- a. **Task:** The TSSC shall update the USGS Quality Assurance Plan for Digital Aerial Imagery and prepare a formal USGS document for release to the public. This document will include discussion definition of all USGS recommended processes.
Deliverable: USGS document as described above.
Schedule: USGS document as described above.
- b. **Task:** The TSSC shall provide remote sensing expertise and communications in a supporting role to the RST Project in its involvement across the USGS and partnerships between the USGS and other Federal agencies, industry, associations and international groups. These partnerships include the following groups but are not limited to: Inter-Agency Digital Imaging Working Group (IADIWG), ASPRS working groups, EuroSDR, and ISPRS, etc.
Deliverable: Provide a supporting role in developing minutes and action items in telecons and meetings as described above.
Schedule: Report progress and status weekly and monthly.
- c. **Task:** The TSSC shall prepare an USGS Implementation Plan that supports the USGS Quality Assurance Plan for Digital Aerial Imagery. TSSC shall provide a detailed implementation plan for signature at USGS Headquarters level showing the interaction and importance of all USGS QA Plan for Digital Aerial Imagery components and the implementation requirements including schedules and milestones. This document will include USGS LRS and NGP funded requirements and methodologies and written, reviewed and made available for USGS Director level signature.
Deliverable: Standard USGS document described above.
Schedule: Standard USGS document described above.
- d. **Task:** The TSSC shall provide lab management support for the EROS Digital Camera Calibration Lab and its contents. This includes assorted lab and hand-held instrumentation and any other RST project equipment and infrastructure. This support shall include inventory tracking, organization, routine and unscheduled maintenance, recommending upgrades and documented procedure maintenance.
Deliverable: Lab management services as described above.
Schedule: Report progress and status weekly and monthly.
- e. **Task:** The TSSC shall provide for the geometric analysis of cameras and lenses in the digital camera calibration lab as directed. Additional systems may be calibrated via reimbursable agreements. The work will not be completed until reimbursable funding becomes available.
Deliverable: Analysis of data and reports of these analyses as camera and lenses become available.
Schedule: Report progress and status weekly and monthly specific calibration reports created and submitted for approval, and archived.

- f. **Task:** The TSSC shall provide support and maintenance for the high-resolution aerial ranges at EROS and Sioux Falls via partner agreements. TSSC shall maintain and update agreement documentation for USGS with these range partners as required.
Deliverable: Develop data provider product validation ranges, agreements and range services as described.
Schedule: Develop data provider product validation ranges and range services as described and as ranges are identified. Report monthly and provided documentation as agreements are established.
- g. **Task:** The TSSC shall support travel, documentation processes and procedures in support of four Manufacturer Sensor-Type Certifications, including updated manufactures certification checklist, defined evaluation criteria document for the checklist and an example summary certification report. These documents will be provided in accordance with USGS reporting procedures for USGS signature.
Deliverable: Support described above documentation, reports, and support for up to four manufacturers.
Schedule: Status shall be provided in monthly reports, and specific calibration reports shall be created, submitted for approval, and archived.
- h. **Task:** The TSSC shall provide support for digital sensor characterizations and research.
Deliverable: Support described above documentation, reports, and support for up to four manufacturers.
Schedule: TBD as completed.
- i. **Task:** The TSSC shall provide a Data Provider Certification Plan for USGS signature. The TSSC shall complete the documentation processes and procedures in support of the Data Provider Certification plan and certifications carried over from previous contract year. If required, the TSSC shall finalize documentation and create an operational and reimbursable process in support of Data Provider Certification processes, including specifically documented and defined evaluation criteria.
Deliverable: Support described above documentation, reports, and support for up to two additional data providers.
Schedule: Provide the draft DP Certification Plan and the final report. Status reports shall be provided in monthly reports, and specific calibration reports shall be created, submitted for approval, and archived.
- j. **Task:** The TSSC shall prepare draft documentation describing the “Federal Imagery Acquisition Guideline” which describes the recommended processes to be used for acquiring digital aerial imagery. The plan shall be presented to the IADIWG.
Deliverable: Support described above documentation.
Schedule: Provide as described above.
- k. **Task:** The TSSC shall complete a USGS Range Specification Document and develop a USGS Range Implementation Plan for ranges across the US in accordance with the Specification Document. These documents must be developed for USGS signature.
Deliverables: The TSSC shall prepare a USGS Range Specification Document and a USGS Range Implementation Plan.
Schedule: Range Specification and Implementation Plan.

- I. **Task:** The TSSC shall develop and support characterization and validation test ranges from across the US for aerial and high resolution satellite systems in accordance with the approved plan. Also included shall be establishing agreements with partners, work-sharing, site layouts and planning and surveying tools as needed. This effort shall include imagery baseline and associated geospatial tools planning. These ranges shall also be designed to aid in JACIE-style characterizations of very high spatial resolution satellites.
Deliverables: The TSSC shall provide support for the development and maintenance of up to four ranges.
Schedule: The goal is to develop agreements for a total of six USGS ranges including the maintenance support and associated agreements. Staffing and preparation for developing and implementing those ranges shall be defined and addressed upon the delivery of the draft Range Implementation Plan.

2.5 Commercial Data Requirements & Acquisition:

The TSSC will provide support for the Commercial Remote Sensing Space Policy (CRSSP) within two Projects - RST and LTA. A common, efficient interface shall be provided to its customers and that interface shall be Customer Services. The first area uses the information within the CRSSP Imagery Derived Requirements (CIDR) data base to validate, analyze civil agency imagery requirements and provide feedback to the Federal agencies that submitted those requirements in an effort to forge partnerships and identifying near term data requirements for procurement in support of civil agencies needs.

The purpose of this task is to understand civil agencies remote sensing needs and availability of aerial and satellite imagery. EROS and RST own the requirement to collect, validate, analyze civil agency imagery requirements and provide feedback to the Federal agencies that submitted those requirements. A data requirements database is maintained, refreshed, and updated regularly for procurement, budget, and collaborative purposes. The CRSSP Imagery-Derived Requirements (CIDR) tool was implemented in FY2005 and allows Federal users to enter data requirements into the CIDR database. RST will use the information within the data base to understand the civil agency remote sensing needs against the available commercial data sources, evaluate the civil agency requirements, and analyze these requirements.

- a. **Task:** Promote CRSSP, the USGS implementation of the CRSSP and the use of the USGS satellite imagery contracts such as Commercial Remote Sensing Data Contract (CRSDC); lead the collection, validation, analysis and feedback (to Federal users) of near-term data requirements; analyze and report civil agency requirements and present the information to RST managers for presentation to the Senior Management Oversight Committee (SMOC), Shared Execution Team (SET), Near Term Requirements Team and participating agencies, and industry; identify a commonality of requirements (potential agency partnerships) and efficiency savings; and improve upon the methods used for spatial mapping of data and data requirements intersections.
Deliverables: Report ongoing requirement for RST and LRS. Power point slides are also required for HQ personnel for use in telecons with HQ and the other Federal civil agency reps.
Schedule: Report on monthly and bi-monthly as required.
- b. **Task:** Provide general and technical assistance to federal customers related to data procurement and data contracts; answer and research customer inquiries (received

via phone, e-mail, fax) related to USGS and other data contracts; support data procurement customers for use of the CRSDC and/or NGA contracts; and help federal customers obtain (procure) imagery from commercial vendors.

Deliverables: Validating the imagery requirements put into CIDR by federal government users. Review the inputs on a regular (daily and at least weekly), ensuring enough information to fulfill the request for imagery. Contact user as required.

Schedule: Report activity monthly.

- c. **Task:** Provide backup and added support to Federal customers requesting commercial satellite imagery based on CIDR and other CRSSP related requirements in Customer Services in response to commercial imagery requirements requests as necessary.

Deliverables: Validate and order imagery products on a level of effort basis as required.

Schedule: Report activity monthly.

2.6 Cross-Cutting Products & Services – Research – All Products – Applied Research:

This Task consists of requirements derived from the Cross-Cutting Products & Services – Camera Calibration Research at EROS and funded by NGP. In conjunction with key staff from the NGTOCs and other USGS facilities, RST plans to continue development of a USGS Aerial Imagery Specification and Quality Assessment Tool (hereafter the “Tool”) to provide users and procurers across the country a resource to 1) develop clear and consistent specifications for digital aerial imagery products suitable for use in contracts, and 2) develop quality assessment processes and aids that will, in parallel with the contracting specifications, assist the users in quantitatively determining that the products received meet those specifications. The Tool shall also support the USGS QA Plan components of data provider certification and associated range development

- a. **Task:** The TSSC shall support the USGS in development of policies and standards for aerial mapping camera characterization and calibration. This support shall include support in photogrammetry, engineering, and the operational implications of these policies and may require attendance in telecons, at meetings, conferences and the development of position papers, policies and other documents. This effort will include the input to ISO standards processes related to camera and sensor calibration called out under the ISO TC211 task.

Deliverable: Provide support and level-of-effort as described above.

Schedule: Provide support and level-of-effort as described above and report activities weekly.

- b. **Task:** The Spec and Check Tool will be web-accessible to USGS staff, liaisons, and partner users across the country. The Tool will be designed with usability across a wide spectrum of users, from NGTOC experts to partners with little or no experience specifying data. Consultation and integration of a broad spectrum of users and experts shall be used to ensure the delivery of a highly useful Tool. TSSC will be responsible for training NGTOC and other Federal contracting users on the use of the tool. TSSC will also be responsible to demonstration of the tool at designed meetings and workshops.

Deliverable: The Tool shall be delivered complete along with a proposal for the tool becoming operational for USGS and USDA official procurement training.

Schedule: A detailed development engineering level plan shall be provided along with requirements and implementation milestones. Monthly progress reports shall include progress against proposed requirements and implementation milestones.

- c. **Task:** The TSSC shall provide a plan for the use of an operational image base-map comparison, correlation, and assessment tool in support of the two task areas described in 2.6.a above. The tool supports both high resolution aerial and satellite data and includes comparisons of other available industry and academia tools as well as those being used and proposed by EuroSDR projects. This plan shall include recommended implementation processes for the USGS and partners.

Deliverable: Provide plan as described above.

Schedule: Provide plan FY09Q3 as described above.

- d. **Task:** The project continues to evaluate new sensors, systems, and technologies that support national land imaging science and provide new mission recommendations and requirements. This effort includes calibration and validation requirements for USGS projects and program. The TSSC shall provide an assessment plan recommending USGS technology assessments including calibration and validation requirement across USGS projects and application. The assessments may include industry and academia support as needed. This plan shall include recommended implementation processes for the USGS and partners. Upon Government approval, the TSSC shall support implementation requirements in the plan.

Deliverable: Provide plan as described above.

Schedule: Provide plan as described above.

3.0 Schedule

Note: Refer to Section 2.0 above.

4.0 Communication

The RST project is a rapidly-evolving project within the USGS. While the roles and future of the project continue to be shaped, general management tasks will be required across the entire Project and will require TSSC support.

4.1 Expectation:

- A TSSC Communication Plan shall provide communication details related to the work of the RST Project including the items mentioned in this section and the deliverables in section 2.0 above as appropriate.
- The TSSC shall continue to provide technical, financial and USGS programmatic support required throughout the entire year. Delivery of the respective work cost and schedule progress reports shall be provided on a monthly and quarterly basis for all project tasks including an overall RST project schedule. While USGS has the responsibility to manage the RST financial budget, TSSC will be required to provide input to RST managers is required.

- TSSC shall provide support and travel to conferences and workshops related to RST project tasks include but are not limited to ASPRS, ISPRS, CEOS, CALCON, and other meetings and conferences including taking meeting minutes, making presentations, and co-authoring technical papers. Written travel reports shall provide a summary, synopsis, recommendations, and actions/conclusions for RST and USGS for all travel performed on project funding.
- a. **Task:** The TSSC shall continue to provide RST general web software support and updates as necessary.
Deliverable: This work shall be delivered in accordance with USGS web practices and policies and shall also be ongoing throughout the contract year.